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OF

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THE LOCAL GOVERNMENT BOARD

1904–05.

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CONTAINING THE

REPORT OF THE MEDICAL OFFICER

For 1904–05.

Presented to both Houses of Parliament by Command of His Majesty.

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REPORT.

TO THE RIGHT HONOURABLE JOHN BURNS, M.P., PRESIDENT OF THE LOCAL GOVERNMENT BOARD.

SIR,

I HAVE the honour to submit a record of the work carried on in the Board's Medical Department in 1904-05.

Certain changes occurred during the year in the personnel of the Department. At the instance of the Royal Society, which in the interests of the Colonial Office, the Admiralty, and the War Department had undertaken investigation of Mediterranean fever, Dr. Ralph W. Johnstone was detached from the staff during four months for epidemiological duty at Malta, and in this interval Dr. Spencer Low was appointed Temporary Inspector in replacement of Dr. Johnstone. At the end of December Dr. D. G. Sutherland was appointed Assistant Bacteriologist in the Board's Glycerinated Lymph Establishment, in succession to Dr. Alan B. Green, who had been elected to the post of Bacteriologist to the Lister Institute. To Dr. Green, while in Government service, the Board are indebted for discovery of the chloroform process in elimination of extraneous micro-organisms from calf vaccine, and for rendering that process available for the Board's purposes.

INTERNATIONAL AND IMPERIAL SERVICE BY THE MEDICAL DEPARTMENT.

INTERNATIONAL CONVENTIC

The International Sanitary Convention of 1903, drafted by the Conference which assembled at Paris in that year, still awaits ratification by the several Signatory Powers. Pending this event, a Bill, empowering the Board to make Regulations authorising measures to be taken, in discharge of international obligations, for the prevention of conveyance of infection, was laid before Parliament, and in due course became law under the title of the Public Health Act, 1904. Under this and other Acts, Regulations embodying the principles of the 1903 Convention have been framed by the Board and will be issued on the ratification of that Convention. A translation of the full text of the Convention has been made by Dr. Theodore Thomson, one of the Medical Inspectors of the Board, and copies of this translation were placed on sale in order

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that Port Sanitary Authorities and their Officers might obtain full knowledge of such of those measures prescribed by the Convention as it may be incumbent on them to take. Dr. Thomson's translation of the Convention is reproduced in Appendix A, No. 1.

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As stated in my Report for 1903-04, the services of Dr. Theodore Thomson were placed at the disposal of the Secretary of State for the Colonies during the first five months of 1904, with a view to Dr. Thomson visiting the British West Indian Colonies, and subsequently attending, in an advisory capacity, a Conference at Barbados on the subject of "Quarantine" Regulations. The Quarantine Regulations then in force in these Colonies had been found productive of serious inconvenience to the travelling public and of grave interference with trade, not only by reason of their want of uniformity, but also because of their excessive stringency. The object of the Conference was to ascertain whether uniformity and diminished stringency could be attained consistently with due protection of the public health. The Colonies represented at this Conference, which was held in April, 1904, were Barbados, British Guiana, Grenada, Jamaica, the Leeward Islands, St. Lucia, St. Vincent, and Trinidad. As a result of their deliberations, the Representatives of these Colonies unanimously recommended the adoption of a Convention and Regulations, the text of which is given in Appendix A, No. 2. In view of the particular circumstances of the West Indies, the provisions which these Regulations embody are, in certain respects, more stringent than those applied in this country. They are, however, in agreement with the principles of the International Sanitary Convention of 1903, and they incorporate a body of measures, carefully considered in relation with local conditions, very greatly in advance of those they were intended to replace. The Convention and Regulations framed at the Barbados Conference have since been adopted by legislation in all the Colonies represented at that Conference.

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Dr. Johnstone's work on the Commission appointed by the Admiralty, the War Office, and the Civil Government of Malta for the investigation, under supervision of the Royal Society, of Mediterranean fever, consisted in strict study of the general sanitary circumstances of the Maltese Islands, with special reference to prevalence therein of this specific fever. In this investigation Dr. Johnstone was fully occupied during the months of July, August, September, and part of October; and subsequent to his return to England he prepared a report of his observations for issue, along with other publications on this subject, by the Royal Society.* Dr. Johnstone's Report will be

* Reports of the Commission appointed by the Admiralty, the War Office, and the Civil Government of Malta for the investigation of MEDITERRANEAN FEVER, under the supervision of an Advisory Committee of the ROYAL SOCIETY. Part II. (April 1905.)

found to contain several sections as follows:—"General Sanitary Survey," "Mediterranean Fever," "Outbreak of Mediterranean Fever in the Essex Regiment," and "General Summary and Conclusions." MEDICAL OFFICER'S REPORT.

Your Medical Officer has remained a Member of the General Medical Council, and has continued to serve on the Royal Commission on Sewage Disposal. As heretofore, he has advised on public health questions affecting this country's Dependencies and Colonies which have been referred to the Board by the Foreign Office and by the Colonial Office, and similarly he has been consulted respecting legislative measures contemplated by the Privy Council and bearing directly or indirectly on health questions. OTHER SUB-DEPARTMENTAL BUSINESS.

Dr. Parsons again acted in 1904 as the Board's Representative upon the Committee of Advice with respect to the Geological Survey. Also he furnished to the Director of the Geological Survey information for the purposes of the survey memoir on the underground water sources of Lincolnshire.

Dr. Parsons, with the Board's consent, served on an Inter-Departmental Committee, appointed by the President of the Board of Education on 14th March, 1905, with the following terms of reference:—

> "(1) To ascertain and report on what is now being done and with what result, in respect of Medical Inspection of Children in Public Elementary Schools."
>
> "(2) And further to enquire into the methods employed, the sums expended, and the relief given by various voluntary agencies for the provision of meals for children at Public Elementary Schools, and to report whether relief of this character could be better organised without any charge on public funds, both generally and with special regard to children who, though not defective, are from malnutrition below the normal standard."

This Committee held 25 meetings and heard the evidence of 44 witnesses. The Report of the Committee was signed on 9th November, 1905.

Dr. Bruce Low having been nominated a Member of a Departmental Committee appointed to inquire into the subject of Vaccination Expenses, served thereon during 1904. The Report of this Committee was issued April, 1905.

Dr. Low continued to serve in 1904 on the Committee which was appointed by the Advisory Board for the Army Medical Services "to direct a course of investigation into the practical prophylactic and therapeutic value of current methods of immunisation against enteric fever." An Interim Report by this Committee is dated 8th July, 1904.

GEN. DEP'S REP.

General Administrative Business of the Medical Department.

Interchange of information and experience in matters relating to public health with officers of other Departments of Government and with representatives of various authorities and public bodies at home and abroad has been practised as in former years. Similarly, conferences have continued to be held at office with local authorities and their officers with reference to prevalences of disease, hospital construction, local byelaws, appointment of officials, and the like. As before, too, advice and assistance have been in numerous instances directly rendered to local authorities by visits of Medical Inspectors. Numerous formal inquiries have been held by these officers into such matters as combination of districts for hospital or other purposes, loans for hospital sites and buildings, proposals as to local byelaws, and schemes for water supply and sewage disposal.

A summary of the total work of the Medical Inspectors is given in Appendix A, No. 3; and in Appendix A, No. 4, will be found abstracts of the several detailed inquiries undertaken by the Inspectors on account of outbreaks of infectious disease or of defective sanitary administration.

With reference to these summaries and abstracts it is satisfactory to note the comparatively few occasions on which visit of an inspector has been concerned with sanitary administration in connection with small pox. In 1904-05 these visits numbered only 20, whereas in 1903-04 and 1902-03 they were 36 and 124 respectively. The diminution here indicated of central intervention in matters of local administration is however to be referred, so far as many rural and most minor urban districts are concerned, almost wholly to subsidence of small-pox, not to any general improvement in the methods of sanitary administration and infectious disease prevention adopted by the authorities of such districts. There had been found, indeed, as a result of visits by inspectors to districts of this class on account of small-pox, serious grounds for suspecting in not a few instances much neglect of sanitary matters generally on the part of the authority and its officers. Accordingly, in 1904-05 opportunity was taken, so far as the resources of the Board's Medical Staff have permitted, to investigate the sanitary state and administration of rural and urban districts in various directions throughout the country. About a dozen separate administrative areas, mainly small urban districts, have come specially under scrutiny during the year, and with results which are far from encouraging. As an extreme instance of the difficulties with which the Board has to contend in attempting to secure satisfactory sanitary conditions and reasonably efficient and uniform administration in not a few rural areas, and especially in paltry "urban" areas into which large thinly populated districts are tending to become split up, the urban district of Preesall with

ADMINISTRATION.

Hackinsall may be cited; report upon which by Dr. Spencer Low will be found in Appendix A, No. 5.

PREESALL WITH HACKINSA

Preesall with Hackinsall, having an area of some 2,900 acres and a population of less than 1,500, was until 1899 a parish of the Garstang Rural Sanitary District. In that year this insignificant "contributory place" was by an Order of the County Council of Lancaster constituted an urban district, *i.e.*, a separate area of sanitary administration. The Local Government Board were powerless to prevent the creation of this authority; the Board were not even consulted in the matter. No petition having been presented to them to disallow the Order of the County Council, all that remained for the Board was to confirm the Order in pursuance of the provisions of sub-section 4 of section 57 of the Local Government Act, 1888. So far as Dr. Spencer Low could ascertain, the County Council in issue of this Order giving sanitary self-government to Preesall with Hackinsall were influenced by contention that the part of rural Garstang in question suffered from lack of sanitary supervision, that it had no proper water supply, that it was without a sewerage system, and that if constituted an urban district improvement of these unsatisfactory conditions was to be counted on. How far this sanguine forecast has been realised is best stated in Dr. Low's words:—

> "It is now more than four years since Preesall with Hackinsall was constituted an urban district, and there is no evidence that material progress has been made towards the improvement in the sanitary circumstances so hopefully foreshadowed in 1899. It is, indeed, difficult to conceive that the conditions of the district, regarded from a sanitary standpoint, can have been appreciably worse at that time than they are to-day. The water supply, unwholesome in quality and of insufficient quantity; the faulty conditions of sewerage, drainage, and disposal of sewage; the serious nuisances, many of them in relation with unsatisfactory disposal and removal of excrement and refuse, in the near neighbourhood of the great majority of dwellings; the neglected state of cowsheds; the entire absence of provision for the isolation of cases of infectious disease other than small-pox and of any trustworthy means of disinfection; the numerous infringements of the bye-laws in force in the district—all bear testimony to the failure of the Urban District Council to perform the duties which have been entrusted to them as guardians of the public health."

It is a matter for serious consideration whether the creation of small urban districts is in the true interests of efficient sanitary administration. Sub-division of administrative districts leads, in the aggregate, to larger disbursements in the way of salaries, due to the multiplication of officers, and in the way of office accommodation for these and for the local

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authority. To justify this increased expenditure the counterbalancing consideration should be increase of administrative efficiency. In districts that, after sub-division, still remain of considerable importance, this result may perhaps be attained, but it may be apprehended that a point of sub-division is not infrequently reached at which the increased expenditure is accompanied by diminished efficiency. If a district be so small that the salaries offered cannot secure competent officers; that it cannot afford the expenditure necessary for works of water supply, sewerage, and the like; that it is unable to provide efficient means of disinfection and hospital accommodation for its infectious sick, and so has to attempt, often without success, to effect these ends by combination with neighbouring authorities; the result of sub-division is clearly decrease in efficiency of administration. At what point as indicated by population the dividing line between increase and decrease of such efficiency is reached, may be a question not easily determined—one to be decided not by an arbitrary standard of population alone, but by other considerations of a local nature. Nevertheless, the amount of population concerned should serve as a guide of considerable value. The number of small districts in England and Wales, however, is such as to suggest doubt whether due value has been given to this guiding principle in their creation. At the census period of 1901, out of a total of 1,122 urban districts, no less than 215 had a population under 3,000. The creation, moreover, of urban districts, even with a population less than half of 3,000, is a continuing condition, inasmuch as 19 with a population under 1,500 have been brought into existence within the last ten years, and, of these, five have been created since 1901. If, as the state of affairs in Preesall with Hackinsall may be taken to indicate, efficiency in sanitary administration is not likely to obtain in small urban districts, it is to be hoped that county councils which alone are competent to dissolve such districts may, prior to making orders for their creation, attach due weight to this consideration.

ERNESS.

In the autumn of 1904 attention was drawn to continued incidence of enteric fever year after year in the urban district of Sheerness, which has a population (exclusive of the garrison) of some 14,300 persons. Dr. Buchanan, who reported on the matter (Appendix A, No. 6), found that detailed investigation of the causes of the excessive prevalence of this disease was impracticable; few observations had been made locally regarding the circumstances associated with the attack of individual sufferers by the fever, and no records of such observations had been kept. The Inspector reported however that an abundance of unwholesome conditions were to be met with in the town, some of which must be considered definitely to favour local spread of enteric fever. The water supply, obtained from deep wells, may be regarded as in itself of satisfactory quality. But the town is at the disadvantage of receiving an intermittent supply of

water, and the customary objections to this arrangement are increased in Sheerness through lack of proper provision for storage of water in dwellings, and absence of flushing tanks to water closets.

Many of the older dwellings of the place have been put up, so to speak, anyhow. Often they are damp, ill-ventilated, and seriously dilapidated; some inhabited houses are described as being beyond repair. In certain parts of the town, dwellings are packed together with little or no open space belonging to them. House drains are frequently leaky, and yards improperly paved and channelled, or not paved at all. Insanitary conditions were found in connection with the more recent dwellings as well as in the older properties. Overcrowding of persons was common, and high rents were not infrequently obtained for miserable accommodation. Not only as regards housing, but in many other matters, including infectious disease prevention, sanitary administration in the customary sense of the word was ascertained to be almost a dead letter. Practically speaking, there was no inspector of nuisances or sanitary inquiry officer in Sheerness. The Medical Officer of Health had no adequate assistance, and important matters affecting public health seldom found a place in the discussions of the District Council. It is satisfactory to learn that since the issue of Dr. Buchanan's report a qualified inspector of nuisances has been appointed to give his whole time to the duties of the office, and it is to be hoped that the Council will shortly be in position to report further action in the direction recommended by the Inspector.

Reference may here be made to addenda to Dr. Buchanan's report. The first of these gives a table showing the annual attack-rate from enteric fever, during the years 1898 to 1901 inclusive, of 90 towns in England and Wales, including 75 towns whose population at the 1901 census exceeded 50,000. This table may usefully be read along with a similar table prepared by Dr. Theodore Thomson in regard of the period 1893-1897, which appears on page 168 of the Annual Report of the Board's Medical Officer for 1898-9. The second, relating to calculation of death-rates in Sheerness, will be of interest to other districts where large allowance has to be made for the presence of a fluctuating garrison population.

Among the comparatively few areas of England and Wales severely affected by small-pox in 1904-05 was the Dewsbury Registration District; report upon the epidemic in which by Dr. S. W. Wheaton is reproduced in Appendix A, No. 7. This Registration District comprises four municipal boroughs and no less than ten urban districts, with a population of some 170,000 persons, mainly engaged in the heavy wool trade and in manufacture of clothes from waste products. For no sanitary purpose, except in a limited sense for hospital provision, is

MEDICAL OFFICER'S REPORT.

there any sort of combination of these 14 separate authorities. In the matter of vaccination administration (which is not, under the English law, a function of sanitary administration) this Registration District is however under the dominion of a single authority. The Guardians of the Dewsbury Union are the authority in question.

At the date when small-pox invaded this area, the Dewsbury Guardians had not only for many years persisted in neglecting their duties under the Vaccination Acts, but had been maintaining an attitude of opposition to the laws to which they were charged by the legislature to give effect. As a result, vaccination had long been discouraged in the several sanitary districts within the jurisdiction of these Guardians. Moreover, the authorities of most of the 14 sanitary areas within the Dewsbury Union had been remiss in providing beforehand hospital accommodation for that abundance of small-pox cases which was to be looked for in the event of epidemic small-pox fastening on the district. Notably the Joint Hospital Board acting for Dewsbury, Ravensthorpe, the two Soothills, and Heckmondwike, though providing for fevers, had failed to set up hospital or hospitals for small-pox; so that on the occurrence of the epidemic in Dewsbury and its neighbourhood the only hospital accommodation available for small-pox was the "Town Small-pox Hospital," situated in an unoccupied portion of a cemetery which intervenes between that borough and Ravensthorpe. The hospital in question is referred to by Dr. Wheaton as consisting of a collection of small galvanised iron buildings, of very dilapidated and forbidding appearance, into which at the date of his visit over 70 small-pox patients had been crowded under conditions the reverse of favourable to recovery from their illness.

Epidemicity of small-pox in the Dewsbury Registration District during 1904 was manifest first in Dewsbury town; later adjoining districts, more particularly Ravensthorpe, became seriously implicated. Early in the epidemic the several authorities concerned were reminded by the Board of their statutory responsibilities in respect of it, and were urged to effective action in coping with the disease. For a while the reports of the Medical Officer of Health of Dewsbury Borough as to the procedures that were being adopted there were not unsatisfactory. But it did not appear from the information with which the Board was furnished that the Dewsbury Guardians, as Vaccination Authority, were affording any special facilities to the inhabitants of invaded areas for obtaining protection against small-pox. The Board, therefore, made further appeal to these Guardians. In reply this Vaccination Authority intimated that they considered it inexpedient and unnecessary to take any steps to secure vaccination or promote re-vaccination among residents in the locality where cases of small-pox had occurred. The epidemic continuing to grow,

especially in the town of Dewsbury, the Board early in September instructed Dr. Wheaton to visit the Registration District, to advise the several authorities called upon to deal with the small-pox, and to report to the Board defects of administration which were conducing to spread of the disease.

Dr. Wheaton found that the epidemic was fast passing beyond control of the sanitary authorities, and that the Dewsbury Guardians were abstaining from doing anything to help them. The Dewsbury Town Small-pox Hospital was, he ascertained, over-full of patients and its administration completely disorganised; and though additional temporary ward buildings were being erected in connection with this hospital, there appeared little prospect of Dewsbury being able longer to receive small-pox patients from other districts. In other ways, too, sanitary administration was defective. At Dewsbury, for instance, there was no efficient disinfection of clothing of contacts, no provision had been made for the temporary accommodation elsewhere than at their homes of contacts from infected houses whilst their clothing and their dwellings were being disinfected, and disinfection of rooms was not thorough. At Ravensthorpe the District Council had no disinfecting apparatus, so that clothing of contacts and clothing and bedding of sufferers by small-pox could not be disinfected; moreover, owing to lack of hospital accommodation, small-pox patients were having to be retained in their homes, their families being meanwhile maintained ("quarantined") at the expense of the Sanitary Authority.

Having received Dr. Wheaton's report, the Board wrote, 22nd September, to the Dewsbury Guardians insisting on the obvious need for a station in the centre of Dewsbury, at which the Public Vaccinator should attend in the evening to perform re-vaccination and primary vaccination of adults and children over one year of age, and pointing out that in view of the increasing demand in Dewsbury for vaccination and re-vaccination a considerable saving on the cost of the operations would probably be effected by this course, if adopted. On the same date the Board wrote to the Joint Hospital Board urging them at once to take steps to secure a site on which to treat small-pox cases, so situated as to minimise the danger of spreading the disease from the hospital to persons residing in its neighbourhood.

Early in October Dr. Wheaton, at direction of the Board, again visited the Dewsbury Registration District. As regards Dewsbury he found at this—his second visit—disposition to more energetic and effective action in several directions by the Town Council. Unhappily, however, of two additional 16-bed wards erected in connection with the Small-pox Hospital, one, when on the point of completion, had been destroyed by fire. As a consequence Dewsbury had decided to reserve for its own

MEDICAL OFFICER'S REPORT.

use all the beds at this hospital, and had declined longer to receive small-pox cases from any outside district. Meanwhile the Joint Hospital Board had not provided any small-pox hospital accommodation.

At Ravensthorpe Dr. Wheaton found conditions greatly altered for the worse, small-pox having much increased. Owing to the decision of Dewsbury not to admit to hospital persons from other districts, no less than 52 small-pox cases were being retained in their homes in this district. These persons were under treatment by the Medical Officer of Health at the expense of the District Council; and several men had been engaged to carry food to the sufferers and to help to prevent delirious patients escaping into the streets. At this date the local authority of this small urban district were expending as much as £50 per week in supplying food and other requisites to "contacts" retained in their homes. For the rest, the conditions at this time obtaining in Ravensthorpe are best described in Dr. Wheaton's own words:—

> "I visited a number of the infected houses and found that the condition of some of the families in which the disease had occurred was altogether pitiable. Nurses had not been provided, and in many instances persons who were only just recovering from small-pox, and were quite unfit to be out of their beds, were attending on relatives who were in the acute stage of the disease. In this respect the women suffered most, since they had in addition to attending the sufferers to perform their ordinary household duties. As a rule the homes of Ravensthorpe are well furnished, and the people are well off in a material sense; but few dwellings have more than two bedrooms, and hence the conditions arising where several cases of small-pox had occurred in the same household were often such as would hardly be credited as possible of existence in a civilised country. In many instances healthy people had to sleep with persons suffering from small-pox; and children were being recklessly exposed to the infection, their parents in many instances refusing to allow them to receive the protection afforded by vaccination. In one small bedroom in a particular dwelling I found three adults suffering from small-pox—one single woman, aged 25, in one bed, and two single men in another; another healthy woman slept at night in the same bed with the female above referred to as suffering from small-pox. Parents still refused to have their children vaccinated, even though exposed to small-pox infection, or to themselves acquire the protection afforded by vaccination or re-vaccination; in one family six small-pox cases had occurred, in another seven. The Ravensthorpe people appeared, indeed, to be quite apathetic as respects small-pox and to have become accustomed to its presence, regarding it as a calamity

which it was hopeless to fight against. In one dwelling which I visited the father had himself suffered from small-pox; in one room upstairs was his son, unvaccinated, in the acute stage of the disease; in another room his wife, vaccinated in infancy by two insertions, also in the acute stage. These people were attended by the daughter, unvaccinated, aged 14 years, who was just recovering from the disease; downstairs were the youngest child who had been vaccinated, after legal proceedings by the Vaccination Officer, and who appeared quite healthy, and an elder child which remained unvaccinated. I urged the father to have this remaining unvaccinated child vaccinated, but he declined. I asked him if he was not convinced of the protection afforded by vaccination since he knew that the medical men who were constantly going in and out of the infected houses had none of them taken the disease; but he replied that the medical men were protected by a charm with which they would not part. The remaining unvaccinated child in question, I was informed, subsequently developed the disease, but the child vaccinated under pressure of the Vaccination Officer remained healthy."

Of the Dewsbury Guardians Dr. Wheaton reported at this stage that they had taken no action for the opening of vaccination stations, or for granting exceptional facilities to the population for obtaining gratuitous vaccination or re-vaccination during the epidemic, or for informing people of the advantage of securing the protection afforded by vaccination and re-vaccination for themselves and their children.

In these circumstances of complete disregard by the Vaccination Authority of the responsibilities placed on them by Parliament, the Board decided to confer on the Dewsbury Town Council powers parallel with those neglected by the Guardians. Accordingly, on 21st October the Board issued an Order under sections 130 and 134 of the Public Health Act, 1875, strengthening the Town Council's hands in dealing with the emergency. This Order, though not superseding the power or duties of the Guardians in the matter of vaccination, empowered the Medical Officer of Health of Dewsbury to perform the vaccination or re-vaccination of any person in that town in danger of contracting small-pox. Also the Order required the Town Council to provide a station or stations for the vaccination or re-vaccination of any inhabitant of the town free of cost. Further, it required the appointment of a medical visitor, if the Medical Officer of Health so advised, to take charge of any sub-division of the borough; to inquire into the existence of small-pox; and to report cases or suspected cases of the disease. Copy of this Order will be found in Appendix A, No. 8. Similar Orders were issued 31st October in regard of Ravensthorpe and Soothill Nether, the districts adjoining Dewsbury, which had then become the most seriously implicated in the prevailing small-pox.

The Dewsbury Town Council, acting at once in the spirit of the Board's Order, specially appointed an Expert Medical Officer to superintend the various measures that were indicated and determined on with a view to getting control of the epidemic; and not very long afterwards the small-pox began rapidly to decline in the borough, so that by the beginning of March the epidemic there was at an end.

In the year ending 25th March, 1905, over 1,600 cases of small-pox occurred in the sanitary districts comprised within the Dewsbury Union. Of these 1,600 cases, over 1,000 occurred in the boroughs of Dewsbury and Ossett and the Ravensthorpe Urban District. During this period of twelve months the extra cost to these three sanitary authorities incurred in combatting small-pox was:—for Dewsbury £12,397, for Ossett £4,615, and for Ravensthorpe £3,386.

In last year's report I drew attention to small-pox prevalence in parts of Essex (Orsett Union) in its relation to the isolation of the small-pox cases of London, during 1901-02, at the hospital ships of the Metropolitan Asylums Board in the Thames. Since then the subject of the spread of small-pox which may be occasioned by small-pox hospitals, has claimed attention in connexion with provincial hospitals.

During recent prevalence of this disease in the provinces it has seldom happened that hospitals used for small-pox isolation have contained an aggregation of acute cases at all comparable to that met with at the hospital-ships in 1901-02, while the majority of these have been purposely placed in situations comparatively remote from populous areas. Nevertheless in exceptional cases the question of "hospital influence" has come into prominence.

The present volume contains two reports (Appendix A, Nos. 9 and 10) of inquiries specially directed to this question; the first relating to the Sheriff Hill Hospital of the Borough of Gateshead, the second to the hospitals used for the isolation of small-pox cases in Liverpool. These two inquiries may be said to have arisen in opposite circumstances. In the case of Sheriff Hill Hospital it was represented to the Board that use of this hospital for small-pox was being attended by exceptional prevalence of the disease in the vicinity. At Liverpool, on the other hand, where two out of the three hospitals utilised for the isolation of small-pox cases during the epidemic of 1902-03 are situated unusually close to populous areas, the Board learnt from a report on the epidemic by the Medical Officer of Health of the City (31st December, 1903) that the areas in question had not appeared to him to have suffered from exceptional incidence of small-pox as a result of the use of these hospitals.

In each case the circumstances suggested that the incidence of small-pox on locality would repay study in detail, and

inquiry was undertaken, at Gateshead by Dr. Buchanan, and at Liverpool by Dr. Reece.

Sheriff Hill Hospital stands on high ground to the south of Gateshead, and during the epidemic of 1903-04 was used for the isolation of small-pox cases in that borough. Within half a mile of it are some 1,300 dwellings, some of which are in the borough, others in the village of Windy Nook in the Urban District of Felling. Dr. Buchanan ascertained the facts as to incidence of small-pox within this half mile area during the whole epidemic, from April, 1903, to May, 1904, and also during four smaller periods of time comprised within the epidemic. These facts are set out in his report together with corresponding data for the whole area of Gateshead and Felling which is more than half a mile from the hospital.

In addition, particulars of small-pox incidence for the same periods were obtained for twelve different "wards" of Gateshead and Felling, each more than half a mile from the hospital, and each containing somewhere about the same number of inhabitants as the area within half a mile of the hospital. When these various data were put together, it became clear that from beginning to end of the outbreak the half-mile area had sustained an exceptionally heavy incidence of small-pox. The facts further indicated that an adverse influence of the hospital in the above sense had been manifest in parts of Gateshead and Felling, which, though outside the half-mile area, are comparatively close to Sheriff Hill, and that within the half-mile area it had been more conspicuous in the case of dwellings near to the hospital than in those further away.

At Liverpool the epidemic investigated by Dr. Reece was on a larger scale than at Gateshead, and the period of small-pox prevalence was longer, from December, 1901, to November, 1903. The two small-pox hospitals in the city to which I have referred are situated about four miles apart, at opposite ends of Liverpool. The smaller hospital, Priory Road, was practically the sole hospital used for small-pox up to the end of November, 1902. Up to this time the epidemic had been of no great magnitude; the largest number of cases admitted to Priory Road Hospital during any single fortnight was 38. In December, 1902, however, the epidemic rapidly increased, and the accommodation at Priory Road Hospital was found insufficient. Small-pox patients were accordingly admitted to a new hospital, Fazakerley, situated in a sparsely populated neighbourhood to the north-east of Liverpool, outside the city boundary. On 12th January, 1903, as further accommodation was not available at Fazakerley or at Priory Road, the second hospital within the city was opened for small-pox. This was Park Hill—a hospital ordinarily used for the isolation of fever cases.

By January 31st, 1903, 95 cases of small-pox had been received in Park Hill Hospital, and for some four months after-

wards the number of small-pox cases admitted to Park Hill ranged between 50 and 130 each fortnight. During this period all three hospitals were in use. In May, 1903, the epidemic began to abate. Admissions to Priory Road Hospital ceased on May 26th, and to Park Hill on July 1st. All small-pox cases which were isolated in hospital after July 1st were received into the Fazakerley Hospital.

The task which Dr. Reece undertook, and carried out with the assistance of officers of the Public Health and other Departments of the Liverpool Corporation, was of some magnitude, and required strict attention to detail and close study and comparison of records obtained from various sources.

After obtaining the facts as to the dwellings in which small-pox occurred, and as to the date on which the first case of the disease in each dwelling came to the knowledge of the sanitary authority, Dr. Reece prepared a series of "spot maps," on which each spot represented a dwelling thus newly invaded by small-pox, for fifty consecutive fortnights. Having ascertained the total number of dwellings in areas respectively within $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, and 1 mile of each of the hospitals in question, and in the whole of Liverpool more than 1 mile from any of the three hospitals, he was in a position to study the relative intensity of incidence of small-pox on these several areas at any given time during the epidemic, and to ascertain whether (after due allowance for the incubation period of small-pox) the use of one and another hospital had in fact been associated with exceptional prevalence of the disease in the hospital neighbourhood. The result which he obtained was striking. With regard to the mile areas round these several hospitals and the sub-divisions of these areas, it became clear that whether the large figures for the large hospital (Park Hill) at the height of the epidemic were taken, or the smaller figures for the smaller hospital (Priory Road) in the early portion of the epidemic, or the figures for the outside (Fazakerley) hospital with comparatively few houses round it, each basis of consideration indicated in its degree and on the invasion rates a like specialised incidence corresponding in point of time to the hospital operations. Further, for the areas within a mile of the hospitals, it appeared that, broadly speaking, dwellings nearest to the hospitals had suffered from a heavier incidence of small-pox than those further away. These facts came out conspicuously in connection with the opening of Park Hill Hospital in January, 1903, as may be seen from the diagrams accompanying Dr. Reece's report.

Since this report was issued some question has been raised locally, not as to the facts recorded by Dr. Reece, but as to his conclusion that the excessive incidence of small-pox on locality, corresponding in point of time to the hospital operations, was causally related to the use of these hospitals for the reception of acute small-pox cases. It has been urged by

the Medical Officer of Health of Liverpool, in a commentary on Dr. Reece's report, that the various circumstances of local distribution to which Dr. Reece drew attention and illustrated diagrammatically may have been matters of mere chance or accident. But it must be admitted that the odds against a series of coincidences which would produce the results in question are very great. And the proposition is rendered more difficult of acceptance when account is taken of the parallel between the behaviour of small-pox in the neighbourhood of each of the three Liverpool hospitals and that which has so frequently occurred in connexion with other hospitals in other epidemics —notably in London, at the time when small-pox cases were isolated in hospitals within the Metropolis, with results recorded in reports made by myself to the Board between 1880 and 1886. Among quite recent instances in which similar "small-pox hospital influence" has been reported are the epidemics in Orsett and Gateshead, above referred to; the epidemics in Glasgow between 1900 and 1904; and that in Philadelphia in 1903-04.

I have above drawn attention to the circumstance that in the neighbourhood alike of the Sheriff Hill Hospital and of the Liverpool hospitals there was evidence of graduation in intensity of small-pox incidence, the proportion of dwellings invaded by small-pox becoming smaller as the distance from the hospital increased. Both inquiries thus indicated the existence of the characteristic distribution which has led to inference that small-pox contagion may on occasion be carried by atmospheric convection currents from the hospital to places in its neighbourhood.

In his Liverpool inquiry, Dr. Reece was concerned with the facts rather than with their explanation, but it appears probable, in view of the efficient organisation of the Liverpool Public Health Department and of the Liverpool hospitals, and of the thoroughness of the efforts made to cope with the epidemic, that hospital communications and traffic had little, if any, share in the excessive incidence of small-pox in the neighbourhood of the several hospitals.

Dr. Buchanan came to a similar conclusion in regard to Sheriff Hill Hospital. He notes that small-pox was exceptionally persistent in the village of Windy Nook, within half a mile of this hospital. This village is in the Urban District of Felling, not in Gateshead, and cases of small-pox occurring in Windy Nook were isolated in the Felling Hospital, more than two miles from Sheriff Hill. Thus the persistence of small-pox in Windy Nook could not be connected with traffic of ambulances between Sheriff Hill Hospital and Windy Nook, or with visits of Windy Nook people to that hospital. Communications of other kinds between persons living in Windy Nook and the hospital at Sheriff Hill were also, practically speaking, non-existent throughout the epidemic.

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THER ISPECTIONS ND QUIRIES.

Dr. Reece has held further conference with officers of Customs and with local sanitary executive officials on the subject of joint procedure by the Customs and Port Sanitary Authority in dealing with sea-borne infectious disease. Among ports specially visited by him in this connection were Bristol, Cardiff, Hull, Liverpool, and Southampton.

Dr. Bulstrode has proceeded with his inquiry respecting Phthisis Sanatoria, and a detailed report by him on this subject is in preparation. From time to time, also, he has continued observation of the shell-fish industry in its health aspects. Thus, he has held inquiry with Major Norton into application by the East Sussex County Council for an Order under section 20 of the Rivers Pollution Prevention Act, 1876, declaring a portion of the tidal Ouse "a stream"; and has made local investigation in consequence of representations as to risk of sewage pollution of shell-fish beds at Brancaster in the Docking Rural District and in the Dee Estuary.

Administrative difficulties having arisen in regard of the Faversham Port Sanitary District, Dr. Buchanan made inquiry into the matter, and subsequently with Mr. Davy attended a Conference of Representatives of Local Authorities whose interests were concerned, for the purpose of discussing arrangements for due discharge of the duties of Port Medical Officer of Health and Port Inspector of Nuisances in the District as a whole, and particularly in Milton Creek. This Conference led to further question of combination of three adjacent sanitary areas, Milton Rural, Sittingbourne Urban, and Milton Urban respectively, for the joint appointment of a single Medical Officer of Health. The proposal was supported by two out of the three sanitary authorities concerned, and appeared to the Board to conduce to greater efficiency of the local sanitary service. Accordingly steps were taken to establish the combination by Order of the Board under section 279 of the Public Health Act, 1875.

Dr. Manby has continued from time to time, by visits to various parts of the country, his inquiry as to "housing" of cows, with special reference to the floor space, the air space, and the lighting afforded per cow.

Investigations by Mr. Huddart of the conditions of employment and of remuneration of Inspectors of Nuisances have been of much advantage to your Medical Officer, in reference to the advice he is called upon to render in the matter of appointment of officers of this class who give only part of their time to the duties of Inspector of Nuisances and are remunerated out of county funds in respect of this part-time service.

In Appendix A, No. 11, will be found a memorandum on the circumstances under which the closing of public elementary schools or the exclusion therefrom of particular children may be required in order to prevent the spread of disease, and

the Board's circular of 7th September, 1904, respecting seizure and condemnation of tuberculous meat. MEDICAL OFFICER'S REPORT.

The memorandum in question was prepared in the Medical Department in view of alterations in the Code of Regulations made by the Board of Education. Antecedent to 1903 this Code of Regulations for Public Elementary Schools provided (Article 101*) that, where the Education Department were satisfied that by reason of a notice of the sanitary authority or any provision of an Act of Parliament requiring the exclusion from school under medical advice of children from infected houses, the average attendance had been seriously diminished, and that consequently a loss of grant would, but for that Article, be incurred, the Department might make a special grant not exceeding the amount of such loss, in addition to the ordinary grant. This provision for a special grant ceased to operate, in consequence of alteration of the Code, after 31st March, 1903, and as a result the Board received during 1904 representations from Medical Officers of Health that abrogation of the special grant was tending to continuation as long as possible at school of attendance of children suffering illness, and to hurrying back to school of such children immediately after seeming recovery, in order to prevent financial loss to school by reason of their non-attendance. There is contention indeed that under the present Regulations it is pecuniarily of greater advantage to school managers to close a school than to exclude from it any considerable number of children.

As to the Board's circular: In reporting on the Tuberculosis (Animals) Compensation Bill, 1904, the Select Committee of the House of Commons had made reference to alleged differences in the practice of different local authorities in deciding the question of total condemnation of carcases of tuberculous animals. Accordingly the Board by means of the circular in question again drew attention to the recommendations made by the Royal Commission on Tuberculosis in their Report of 1898 on the principles to be observed in the inspection of tuberculous carcases of cattle, and intimated to local authorities that it was expedient and desirable that meat inspectors should act in strict accordance with these principles. Opportunity was also taken to express the Board's view that it is undesirable that a local authority should institute proceedings against a butcher who, being in possession of tuberculous meat, has voluntarily and promptly notified the fact of such possession to the proper authority.

Vaccination and Public Vaccination.

The number of Unions inspected in 1904 in regard to vaccination amounted to 240, comprising 1,326 public vaccinators' districts. The Public Vaccinators of 896 of these districts were INSPECTION OF VACCINATION.

MEDICAL OFFICER'S REPORT.

recommended for award under section 5 of the Vaccination Act, 1867 (Appendix A, No. 12).

EDUCATION IN VACCINATION.

In Appendix A, No. 13, will be found a list of Educational Vaccination Stations, with the names and addresses of the teachers of vaccination authorised, under Orders of the Board, to grant special certificates of proficiency in vaccination necessary as part of the medical qualification for entering into contracts for the performance of public vaccination.

ANIMAL VACCINE ESTABLISHMENT.

The Director of the Animal Vaccine Establishment, Mr. Thomas S. Stott, reports (Appendix A, No. 14) that during the year ending 31st March, 1905, the number of vaccinations performed at the Board's Station, Lamb's Conduit Street, amounted to 1,368. All were primary vaccinations.

GLYCERINATED CALF LYMPH.

In 1904-05, small-pox, as in the preceding year, remaining for the most part in abeyance, no exceptional demand was made on the resources of the Board's Glycerinated Lymph Establishment. Dr. Blaxall reports (Appendix A, No. 15) that during the twelve months in question there were issued from the Board's Laboratory 644,350 charges of glycerinated calf lymph, of which amount about one-tenth was utilised by the public vaccinators in secondary vaccination. The lymph thus issued proved of the customary high quality; in primary vaccination the "case success" was 98·5 per cent., the "insertion success" 93·5 per cent.

VACCINATION OFFICER'S RETURNS.

That the better observance in England and Wales of the Vaccination Law of 1898, on which stress was laid in the last report of your Medical Officer, has been satisfactorily maintained notwithstanding abeyance of small-pox, is broadly indicated by the subjoined figures extracted from the Annual Returns of the Vaccination Officers, which are published from year to year in the Board's Annual Volume.

England and Wales.

Year.	Births.	Vaccinated.	Insusceptible.	Had Small-pox.	Exempted.	Died Unvaccinated.	Postponed.	Remaining.	Not accounted for (including cases postponed) per cent. of Births.
1898 ..	923,059	562,737	3,232	4	47,423	110,912	16,921	181,830	21·5
1899 ..	929,189	617,113	5,379	4	33,573	113,516	16,605	142,999	17·2
1900 ..	927,222	636,940	2,261	2	39,699	103,538	14,225	130,557	15·6
1901 ..	929,882	664,366	2,631	27	39,925	102,007	12,317	108,609	13·0
1902 ..	940,509	703,721	3,027	27	33,759	90,826	12,213	96,936	11·6
1903 ..	948,383	714,637	2,573	17	37,675	91,754	12,489	89,238	10·7

From the above table the relative proportions of "abstention from" and "acceptance of" vaccination may conveniently be brought in contrast as follows:—

England and Wales.

	Per cent. of Births in each instance.						
	1893–97.	1898.	1899.	1900.	1901.	1902.	1903.
ABSTENTION. ("Exempted," "postponed," and "remaining").	21·0	26·6	20·8	19·9	17·3	15·2	14·7
(*Exemptions alone*) ...	—	*5·1*	*3·6*	*4·3*	*4·5*	*3·6*	*4·0*
ACCEPTANCE. (Vaccinated)	67·7	61·0	66·4	68·7	70·8	74·8	75·4

The general upward tendency in the matter of infantile vaccination thus exhibited has not, of course, owing to local diversities of administration, been universal. Many counties of England and Wales have shown, and continue to show, a far higher percentage of "births vaccinated" than the country as a whole. On the other hand there are counties which in this matter remain below the mean of England and Wales. And as with counties so with Poor Law Unions, the areas directly concerned in vaccination administration. Nevertheless, on making comparison of the present and the past, of the single year 1903 (Appendix A, No. 16) with the five years 1893-97 antecedent to operation of the new law, there is observed, alike with counties and with Unions, an advance from a lower to a higher grade in "acceptance of vaccination" that is well-nigh free from exception.

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And first as regards the 55 Counties:—

55 Counties of England and Wales.

Grade.	Percentage of Births Vaccinated.	Counties in each Grade.			
		1893–97.		1903.	
		Number.	Per cent. of total Counties.	Number.	Per cent. of total Counties.
I.	90 and upwards ...	Nil	34·5	Nil	50·9
	85–90	6		16	
	80–85	13		12	
II.	75–80	8	30·9	11	30·9
	70–75	9		6	
III.	65–70	6	18·2	3	10·9
	60–65	4		3 (*c*)	
IV.	50–60	6 (*a*)	16·4	2 (*d*)	7·3
	less than 50	3 (*b*)		2 (*e*)	

(*a*) Derby. Gloucester. *Norfolk.* *Notts.* Wilts. Radnor.

(*b*) Bedford. Leicester. Northants.

(*c*) *Gloucester.* *Wilts.* *Radnor.*

(*d*) *Bedford* Derby

(*e*) Leicester. Northants.

Italics signify ascent, ordinary type no change, in grade.

The circumstance that more than half, instead of as in 1893-97 about one-third, of the counties show 80 per cent. of their births "vaccinated" is, administratively, highly satisfactory. And as regards the balance of counties less high in the scale the figures of the table are for the most part distinctly encouraging, particularly those indicating tendency of certain of the few counties at the bottom of the scale to pass to a grade that is higher.

As regards Unions, the data to be extracted from the Vaccination Officers' Returns for 1903 and for former years are

broadly similar to, but on the whole more satisfactory than, those already exhibited for the counties. Of 615 Unions in England and Wales (exclusive of those within the Metropolis to be presently referred to) no less than two-thirds show "births vaccinated" to the extent of 80 per cent. and upwards; and, as regards the remaining third of these Unions, a tendency upward from lower to higher grade is, as in the case of counties, conspicuous. And as with the counties so with the Unions, the proportion of the whole number found in grade II.—*i.e.*, showing 70-80 per cent. of births vaccinated—remains practically the same in 1903 as in 1893-97. In 1903 grade II. has, alike as regards Unions and Counties, parted with its substance in no inconsiderable amount to grade I., while recruiting itself as it were for its losses at the expense of grades III. and IV.

These facts as to the 615 Unions are set out in the following table:—

615 *Unions of England and Wales.*

Grade.	Percentage of Births Vaccinated.	Unions in each Grade.			
		1893–97.		1903.	
		Number.	Per cent. of the 615.	Number.	Per cent. of the 615.
I.	90 and upwards ...	18	55·0	53	66·7
	85–90	155		219	
	80–85	165		138	
II.	75–80	81	20·2	72	18·7
	70–75	43		43	
III.	65–70	27	7·3	21	5·9
	60–65	18		15	
IV.	50–60	26	17·6	30	8·8
	Less than 50	82		24	

With reference to the Metropolis which, as shown in previous reports, comprises Unions as unsatisfactory almost in the matter of vaccination administration as any in England and Wales,

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the facts as to "abstention from" and "acceptance of" vaccination in the period 1893-97 and in subsequent years are set out in the subjoined table:—

Metropolitan Unions.

	Per cent. of Births in each instance.						
	1893-97.	1898.	1899.	1900.	1901.	1902.	1903.
ABSTENTION. ("Exempted," "postponed," and "remaining.")	23·9	34·4	23·7	26·8	25·2	22·1	21·7
(*Exemptions alone*) ...	—	*1·4*	*1·0*	*1·0*	*1·1*	*0·8*	*1·0*
ACCEPTANCE. (Vaccinated)	65·4	53·8	58·8	61·7	64·3	68·0	68·9

London, it is seen, has, as regards births vaccinated, remained year by year at disadvantage compared with the rest of the country, and this notwithstanding that in the Metropolis the "conscientious objector" is rarely found. The status, actual and relative, of the several Metropolitan Unions, as regards "acceptance of" vaccination in 1893-97 and in 1903, is exhibited in an additional table.

31 *Metropolitan Unions.*

Italics signify ascent, [ ] descent, in grade.

Grade.	Percentage of Births Vaccinated.	Unions in each Grade. 1893-97. No.	Names.	Per cent. of Total Unions.	1903. No.	Names.	Per cent. of Total Unions.
I.	90 and upwards.	Nil	—	—	Nil	—	—
	85-·0	2	Whitechapel .. Woolwich ..	19·4	2	*St. George's, Hanover Square.* *Kensington*	25·8
	80-·5	4	St. George's Hanover Square. Greenwich .. Hampstead .. Paddington ..		6	*Hammersmith* .. Hampstead .. *Marylebone, St.* .. *Westminster* .. [Whitechapel] .. [Woolwich] ..	

Italics signify ascent, [ ] descent, in grade.

Grade.	Percentage of Births Vaccinated.	Unions in each Grade. 1893-97. No.	Names.	Per cent. of Total Unions.	1903. No.	Names.	Per cent. of Total Unions.
II.	75-80	5	Chelsea	35·4	6	Chelsea	35·4
			Fulham			Fulham	
			Hammersmith ..			[Greenwich] ..	
			Kensington ..			*Lewisham*	
			City			City	
	70-75	6	Lewisham ..			[Paddington] ..	
			Marylebone, St...		5	*Bermondsey* ..	
			St. Pancras ..			*Camberwell* ..	
			Strand			*Islington*	
			Wandsworth ..			*Lambeth*	
			Westminster ..			Wandsworth ..	
III.	65-70	6	St. George-in-the-East.	25·8	4	St. George-in-the-East.	22·6
			St. Giles			St. Giles	
			Holborn			Holborn	
			Islington			[Strand]	
			Bermondsey ..				
			Southwark ..				
	60-65	2	Camberwell ..		3	*Hackney*	
			Lambeth			[St. Pancras] ..	
						[Southwark] ..	
IV.	50-60	2	Poplar	19·4	2	*Shoreditch*	16·2
			Stepney			Stepney	
	less than 50	4	Bethnal Green ..		3	Bethnal Green ..	
			Hackney			Mile End	
			Mile End			[Poplar]	
			Shoreditch ..				

Plague.

Plague in India during 1904 attained a greater prevalence than in any year since 1896. From Dr. Bruce Low's summary of the progress and diffusion of this disease throughout the world (Appendix A, No. 17) it appears that for that country as a whole, in 1904, plague attacks were 192,125, and plague deaths 245,725, in excess of the figures for 1903. Despite, however, this unfavourable record, Dr. Low supplies facts respecting plague in India which may be deemed of favourable augury. For the first time in several years Bombay Presidency, which has been so long notorious for plague, exhibited diminution of epidemicity of the disease; and the like is true of Bombay City. In the former, plague deaths in 1904 were less by 77,000, and in the latter by 7,250, than in 1903. The chief of the Provinces and States which suffered more plague in 1904 than in the previous year were Madras, Bengal, Agra with Oudh, the Punjaub, Rajputana, and Kashmir. Of these the Punjaub suffered by far the most seriously.

MEDICAL OFFICER'S REPORT.

China and other far Eastern Countries would seem to have suffered less notably from plague than in recent years. Hong Kong, for instance, recorded in 1904 a plague mortality little more than half that of 1903. Japan suffered hardly at all: in Formosa alone was there definite increase of plague beyond that of former years. The Australian Colonies, though not entirely free from plague, did not exhibit any definite prevalence of the disease.

On the North America Continent no plague, beyond a few cases at San Francisco, was heard of. But in South America the disease was present, as in other years, in various localities, as for instance at Rio de Janeiro, and in parts of Brazil, Argentina, Chili, and Peru. No plague, however, was reported from Rosario and other centres of grain export from the River Plate.

In South Africa scattered cases of plague were recorded from time to time, as at Port Elizabeth and at Durban; only at Johannesburg, however, was there decided, though limited, outbreak of the disease.

The Island of Mauritius, where plague appears to have become endemic, suffered once again from seasonal multiplication of the disease. But plague deaths here, in 1904, were less than half as numerous as in the preceding year.

Aden, which since 1900 had been practically free from plague, reported a few scattered cases early in 1904. Later in the year and in the first months of 1905 the disease attained considerable prevalence, causing above 1,500 deaths.

Egypt suffered plague in excess of that witnessed in the country in any of the preceding four years. No less than 23 separate localities were invaded; but the disease, though widespread and causing more than three times as many deaths as in 1903, was nowhere, except perhaps in Alexandria, very abundant. The total recorded plague attacks in Egypt during 1904 number 854, and the deaths by the disease 501.

Notwithstanding the above condition of plague prevalence in Egypt, little was heard of the disease in Mediterranean and Black Sea ports in direct communication by sea with that country.

In European Russia, plague, derived probably from some source other than Egypt, made its appearance on the eastern boundaries, in Ural territory for instance, but failed in developing definite epidemicity.

As regards Germany and France, sea-borne plague alone was noted, and of such cases the number was trifling in comparison with that in other years. Only two vessels, the "Bishopsgate" and the "Weybridge" to Tyne and Thames, respectively, brought actual plague to England. In neither instance was there extension of the malady.

Cholera.

In 1904, cholera in India was generally much less abundant than in any year since 1899. In Bombay Presidency alone was more cholera witnessed than in 1903, mainly owing to dissemination of the disease by persons dispersing from Ashadi fair. Elsewhere, in countries of the Far East, from which authentic records are received, cholera was decadent or absent; and the Mecca Pilgrimage of 1904 passed off without appearance of the disease in the Hedjaz.

Egypt remained throughout the year completely free from indigenous cholera, as was also the case with Palestine, into which country the disease had extended from Egypt in 1902-03. There was, however, recrudescence in Mesopotamia of the cholera which, in 1903, had invaded that country viâ Syria and had then trended southward toward the Persian Gulf. In the early summer of 1904 the disease became prevalent at various points in the Tigris-Euphrates Valley, and passing eastward into Persia affected epidemically above a dozen provinces of that country. From Persia cholera advanced again northward—carried, it is believed, by cholera-fugitives from Meshed and other Persian towns—into Russian territory east of the Caspian. By the end of August, notwithstanding precautions by the Russian authorities, cholera had made transit of the Caspian Sea, westward toward Baku and northward to the mouth of the Volga. From Baku the disease spread further west, invading a number of districts along the line of railway to Batoum, which Black Sea port became implicated in December. Happily, no extension of cholera to Europe occurred by this route; but with the cholera which had passed north to the mouth of the Volga it was otherwise. The provinces of European Russia which thus became invaded by September, 1904, were Astrachan, Saratov, Samara, and Nijni Novgorod. At the end of the year the Russian Government declared the shores of the Caspian Sea, and the Governments of Astrachan, Saratov, Sambirsk, Kazan, and Nijni Novgorod regions "threatened by cholera."

In the circumstances, cholera having in 1904 followed a westward route (Appendix A, No. 18), which previous experience had shown to be a danger to all Europe, the further westward extension of this disease to Baltic and North Sea ports, which took place in 1905, was fully anticipated.

Auxiliary Scientific Investigations.

Rats and plague.

In further study of plague Dr. Klein (Appendix B, No. 1) has been taking account of different methods by which rats may become plague-infected.

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While regarding fleas as possible transmittors of plague among rats, he has been disposed to consider casual plague contamination of pre-existing wounds on rats, and bites by actually infected rats, as likely to be under natural conditions much more potent in distributing plague among these animals than bites inflicted on them by previously and recently infected fleas. The above provisional conclusion that it is by means of what may be termed "surface inoculation" that plague is in the main spread among these rodents, had been arrived at, Dr. Klein notes, in view of his own repeated failure, as also failure of other persons, to convey plague to the rat by feeding, a method of infection of this animal which he had *primâ facie* regarded as much the most likely. Reconsidering the matter, however, it occurred to him that failure in the above sense to infect the rat by ingestion of plague material possibly had been due to a germicidal action on B. pestis of the acid secretions of the stomach during the earlier stages of digestion; and he came to suspect that if B. pestis could find means of reaching the small intestine unscathed, the activities of this micro-organism in inducing plague in the experimental animal would be exerted in full vigour. He undertook, therefore, a fresh series of experiments with the object of administering to rodents plague material safe-guarded as it were against germicidal action of the gastric juice in its passage through the stomach to the intestine.

In preliminary experiments for this purpose Dr. Klein employed plague cultures which, having been growing for several weeks, had become dried at their margins and which yielded a number of individual colonies that were "angular, granular, opaque, raised, and dry-looking." These drying cultures, having been mixed with bread and administered by feeding to three rats, produced some striking results. Of these rats two died promptly of plague, and both presented on post-mortem examination anatomical appearances as follows:—

> "In the lower ileum of each rat there was hæmorrhage around a swollen and partially necrotic Peyer's gland, the mesenteric glands in the neighbourhood being found swollen, deep purple in colour and hæmorrhagic. Examination of stained and mounted sections of the hæmorrhagic Peyer's patch and of the swollen hæmorrhagic mesenteric glands left no doubt at all that in each instance a Peyer's gland had been the nidus of infection of the rat. Not only was there observed abundance of B. pestis in and about the necrotic Peyer's patch, but also it was seen that the lymphatics of the affected part of the intestine (villi, mucosa, sub-mucosa, and muscular coat), the mesenteric glands, and the vascular system in general had become literally packed with B. pestis."

By repetition on a considerable scale of similar experiments —that is by feeding separate series of rats, guinea pigs, and

mice, with drying cultures, or with fresh plague organs or fresh culture of B. pestis mixed with wheat and with rice and dried for 2-3 days over sulphuric acid—Dr. Klein obtained in the majority of instances a like and practically uniform result; namely, infection of the animal at a given point in the intestine, as indicated by each and all the appearances, anatomical and microscopical, above referred to. In a word, Dr. Klein succeeded in showing that given a protective envelope, as by the methods adopted by him, B. pestis can pass in security through the stomach of the rodent to be released from its incarceration in the later stages of digestion and left free to fasten on the intestinal tissues of its host, so as effectually to infect it with plague.

Question must needs arise, as Dr. Klein does not fail to point out, in the light of these new observations as to the part played by ingestion of infection in dissemination of plague among different races of man; and, no doubt, as a first result certain of the facts recorded by Dr. Klein will prove incentive to strict scrutiny by actual observers of plague in man of the pathological conditions of the lower intestine of persons who have died of the disease. Meanwhile, Dr. Klein has been seeking to ascertain, in view of the well-known germicidal effect of dessication on B. pestis, the degree of drying that the plague micro-organism, when associated under diverse conditions with various materials—food stuffs, earth, and sand—will tolerate without parting with its ability to infect the animal body. His investigations in this direction will have interest for the etiologist.

BIOLOGY O EXCREMEN AND WATE

In Appendix B, No. 2, Dr. Houston, reporting on further investigation by him of the biology of excrement and of water, indicates need for caution in interpreting the results obtained from bacterioscopic testings of water samples. He has investigated cow dung on the lines previously adopted by him in the case of human fæces, and the excrement of fish and of sea fowl; his object being, as before, to determine, as regards water presumably contaminated with excrement, the nature of such excremental pollution, whether from human or from other animal source. But he finds that the excrement of cows contains in like proportion with human excrement the micro-organisms upon which biological judgment of water samples is apt to be based, namely, coli-like microbes and B. enteritidis sporogenes; that these microbes from cow dung are not to be distinguished by the tests used in his investigation from those of human fæces; and that in excrement from both sources the ratio of typical B. coli to total coli-like microbes is practically identical. As regards streptococci alone does Dr. Houston hope for a means of distinguishing human excremental pollution from that derived from other animal source.

If it may be assumed that other lower animals besides the cow, deer for instance, yield excrement not to be distinguished

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bacteriologically from the excrement of man, the fact recorded by Dr. Houston that a Scottish loch, topographically so situated as to forbid belief in contamination of its contents with human dejecta, nevertheless yielded water containing not only coli-like micro-organisms, but also on occasion typical B. coli, is no way surprising. Dr. Houston's observations indeed tend to the inference that upland surface waters in this country are hardly to be found entirely free from micro-organisms regarded as essentially intestinal in origin. In contrast to such experience are the facts as to certain underground waters which have undergone natural filtration in their passage through several miles of sand and rock. Of the Tunbridge Wells water Dr. Houston records that comparatively seldom did he even in 1,000 c.c. samples detect coli-like microbes, and that 1,000 c.c. samples of this water scarcely ever yielded him a micro-organism bearing resemblance to typical bacillus coli.

EMICAL DUCTS OF ENTERI-DIS.

Dr. Sidney Martin reports on investigation of albumoses and other chemical products obtained by him as a result of growing B. enteritidis sporogenes on various media (Appendix B, No. 3). For this purpose, starting with cultures of ascertained pathogenicity to guinea pigs, the bacillus was grown respectively in broth, liquid serum, alkali-albumen broth, and solid serum. A noteworthy point in these experiments is the evidence obtained that the bacillus produces a powerful proteolytic ferment, and that it is to the excretion of this ferment that the rapid liquefaction of solid blood serum is due. As to the physiological effect of the products of growth of the bacillus in these various media, Dr. Martin has only negative results to record. The consequent presumption that the toxicity of bacillus enteritidis to rodents depends upon presence of an endotoxic substance in the bodies of the bacilli could not, however, be put fully to the test, owing to difficulty experienced in obtaining dried bacilli without accompanying spores.

ER-ATIONS AGGLU-INS."

Dr. Martin having reported last year upon the property of agglutinating B. proteus which is acquired by the blood serum of rabbits subjected to repeated inoculation with sub-lethal doses of proteus toxin, now describes (Appendix B, No. 4) experiments undertaken to ascertain whether blood serum thus obtained possesses agglutinative properties in regard to B. coli, or to B. typhosus, or to the "paratyphoid" bacillus.

Each of these three bacilli resembles B. proteus in that it contains in its protoplasm an endotoxin, which when injected intravenously into rabbits produces physiological effects very similar to those produced by proteus endotoxin. Each of the bacilli in question also gives rise to an agglutinin in the serum of an experimental animal when its endotoxin is suitably injected. Nevertheless, as is well-known, B. proteus in its life history, and particularly in the chemical processes with which it is associated, differs very greatly from the others. As a result of his investigations, Dr. Martin concludes that blood serum

of rabbits possessing strong agglutinative action as regards proteus, is without any agglutinative action (even in low dilution) on B. coli, B. typhosus, or B. paratyphosus, while conversely sera which strongly agglutinate B. coli, B. typhosus, and B. paratyphosus respectively, have no agglutinating action (even in low dilution) as regards B. proteus. Setting aside proteus, and dealing with the inter-relations of the agglutins produced by each of the other three organisms, the result was somewhat different. In higher dilutions of the serum (*e.g.*, 1 in 5,000) the agglutin appeared to be uniformly specific in its action; paratyphosus serum for example agglutinated B. paratyphosus but not B. typhosus or B. coli. In lower dilutions however the specific property was in several instances less apparent. As a rule, dilution of 1 in 100 sufficed to enable the nature of the agglutinin to be distinguished.

AIR-BORNE INFECTION.

In continuation of his study of air-borne infection Dr. Mervyn Gordon has sought (Appendix B, No. 5) to ascertain whether any particular micro-organism, by reason of the constancy and abundance of its occurrence in the human epidermis, can serve as index of the presence in air of particulate matter shed from the surface of the human body.

Antecedent investigation had showed that though a certain class of micro-organism, namely staphylococcus, is uniformly present on the surface of the normal skin, cultural tests then available to the biologist did not suffice for the purpose of definitely deciding whether any of these staphylococci are peculiar to the skin and different therefore from staphylococci from other sources. In further pursuing this matter Dr. Gordon adopted therefore a method which he had found of value in distinguishing between streptococci, namely, utilising the different ability of micro-organisms belonging to one and the same group to decompose particular organic substances. Tested in this way, staphylococci in considerable number and from a variety of sources could, it was found, be satisfactorily differentiated.

Thus equipped, Dr. Gordon has during the past year made extensive investigation of staphylococci present on the skin of normal individuals. As the hand, face, and scalp comprise the regions of skin commonly exposed to the air and specially liable therefore to contribute particles thereto, he for the while limited his investigation of skin staphylococci to those found on these parts of the body. As a result he has been able to show that though a variety of micrococci belonging to the staphylococcus group, or closely allied organisms, occur on the normal integument, one staphylococcus in particular, possessing certain distinctive properties, is so uniformly present on the skin of all the parts of the body examined that it may be considered characteristic of the human integument—in much the same way apparently that other micro-organisms are commonly regarded as characteristic of other parts of the human body.

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This staphylococcus therefore promised to provide the index required.

Dr. Gordon's next step was to examine outdoor air and indoor air with a view to determining whether the above staphylococcus did as matter of fact serve the purpose of betraying the presence of skin particles detached from the human body. The answer proved to be affirmative. Outdoor air, though yielding staphylococci of various kinds failed to yield a single staphylococcus that could be identified with Dr. Gordon's skin staphylococcus. Similarly, indoor air, when few or no persons were present, failed also in yielding this index micro-organism. But on a plurality of occasions, when a number of persons were gathered together within doors, Dr. Gordon succeeded in demonstrating the presence in the air of the room of his special skin micro-organisms.

In view of the circumstance that certain staphylococci are not infrequently associated with disease processes in man, Dr. Gordon has utilised opportunity of submitting examples of virulent staphylococci to his several differential tests. The facts which he records in this connection give promise of useful application of these tests in sorting out, with precision greater than has hitherto been practicable, disease-producing staphylococci.

In Appendix C Dr. Alan Green reports on chloroformed calf lymph to 31st December, 1904—the date on which he retired from the Board's service.

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The main interest of this final report by Dr. Green is record of experiments in the subjection of lymph to glycerine as well as to chloroform; his object being to ascertain in regard of lymph to be thus dealt with, the stage at which in preparation of the lymph it is most advantageous that the glycerine be added. As a result Dr. Green finds that it is preferable always to defer addition of glycerine to the vaccine emulsion until such time as the work of the chloroform in removing extraneous bacteria has been fully performed, and until the chloroform itself has been completely removed from the vaccine. For the rest, Dr. Green renders account of 56 chloroformed vaccines prepared by his process and which have been issued by the National Vaccine Establishment to Public Vaccinators. These 56 vaccines have, it appears, been employed in the vaccination of 56,387 persons, and have yielded as regards "case success" and "insertion success" results showing the highly satisfactory proportions of 98·1 and 92·9 per cent., respectively.

I have the honour to be,

Sir,

Your obedient Servant,

W. H. Power.

APPENDICES.

APPENDIX A.

No. 1.

THE INTERNATIONAL SANITARY CONVENTION OF PARIS, 1903; with Appendices translated by Dr. THEODORE THOMSON, one of the Medical Inspectors of the Local Government Board, and one of the British delegates at the International Conference at which the Convention was made.

APP. A, No. 1
Translation of the International Sanitary Convention, 1903; by Dr. Theodore Thomson.

PART I.

General Provisions.

CHAPTER I.

PROVISIONS TO BE OBSERVED BY THE COUNTRIES SIGNING THE CONVENTION ON THE APPEARANCE OF PLAGUE OR CHOLERA IN THEIR TERRITORY.

SECTION I.—*Notification and subsequent communications to the other countries.*

Art. 1.—Every Government must immediately notify to the other Governments the first appearance of recognised cases of plague or cholera in its territory.

Art. 2.—Such notification shall be accompanied or very promptly followed by detailed information as to:—

(1) where the disease has appeared;

(2) the date of its appearance, its source, and its type;

(3) the number of known cases and deaths;

(4) in the case of plague, the presence of that disease or unusual mortality among rats or mice;

measures taken immediately on the first appearance of the disease.

3.—The notification and the information prescribed in s 1 and 2 shall be supplied to the diplomatic or consular ies in the capital of the infected country. In the case of tries not represented there, the notification and the in- tion shall be telegraphed direct to the Governments of ountries.

Art. 4.—The notification and the information prescribed in Articles 1 and 2 shall be followed by subsequent communications furnished regularly and in such fashion as to keep the Governments informed of the course of the epidemic. These communications shall be made at least once a week, shall be as complete as possible, and shall, in particular, indicate the precautions adopted with a view to prevent spread of the disease. They must set out with precision:—

(1) the preventive measures taken in the way of sanitary inspection or of medical investigation, of isolation, and of disinfection;

(2) the measures adopted in the case of outgoing vessels to prevent exportation of the disease, and, particularly, in the case contemplated in Art. 2 (4), the measures taken against rats.

Art. 5.—It is of primary importance that the foregoing provisions be promptly and scrupulously complied with. Notification is of no real value unless every Government be itself informed, in time, of cases of plague and cholera and also of doubtful cases occurring in its territory. It cannot therefore be too strongly impressed on the several Governments that they should make notification of plague and cholera compulsory, and that they should keep themselves informed as to any unusual mortality among rats or mice, particularly in ports.

Art. 6.—It is to be understood that neighbouring countries reserve to themselves the right to make special arrangements with the object of organising direct exchange of information between the principal administrative officers on their frontiers.

SECTION II.—*The conditions under which a local area may be regarded as infected or as having ceased to be infected.*

Art. 7.—The notification of a first case of plague or cholera shall not lead to the adoption of the measures prescribed in the following Chapter II. against the local area in which the case has occurred. But when several non-imported cases of plague have occurred, or when the cases of cholera constitute a *foyer*,* the local area shall be declared infected.

Art. 8.—In order that the measures be limited to places which are infected, Governments must apply them to arrivals from infected local areas only. "Local area" means a portion of territory clearly defined in the information that accompanies or follows notification—as, for instance, a province, a "government," a district, a department, a canton, an island, a commune, a town, a quarter in a town, a village, a port, a polder,

* *Translator's note. The expression "centre of dissemination" may be taken as a fair equivalent for the word "foyer." It seems desirable, however, to retain the original term in the text, in view of the difficulty of deciding what is to be regarded as constituting a "foyer" of cholera. This question was debated at some length at the Dresden Conference in 1893, and was again raised at the Paris Conference in 1903 by the translator and others. At the Dresden Conference, Professor Brouardel, one of the French delegates, stated that an exact definition of the word "foyer" was a difficult matter. At the Paris Conferenae in 1903, the word, after some discussion, was retained without definition of its precise significance in relation with cholera.*

an agglomeration, &c., whatever may be the extent and population of these portions of territory. But this limitation to the infected local area must be accepted only on the definite condition that the Government of the infected country take the measures necessary (*a*) for preventing the export of the things specified in Art. 12 (1) and (2) derived from the infected local area, unless previously disinfected, and (*b*) for checking the spread of the epidemic.

When a local area is infected, no restrictive measure shall be taken against arrivals from that local area, if they have left it not less than five days before the beginning of the epidemic.

Art. 9.—In order that a local area cease to be regarded as infected it must be officially established:—(1) that no death from nor fresh case of plague or cholera has occurred within the five days following either the isolation* or the death or recovery of the last case of plague or cholera; (2) that all measures of disinfection have been carried out and that, in the case of plague, measures have been taken against rats.

CHAPTER II.

MEASURES OF DEFENCE, ON THE PART OF THE OTHER COUNTRIES, AGAINST TERRITORIES THAT HAVE BEEN DECLARED INFECTED.

SECTION I.—*Publication of measures prescribed.*

Art. 10.—The Government of each country shall immediately make public the measures which it considers necessary to prescribe with regard to arrivals from an infected country or local area. It shall forthwith communicate these measures to the diplomatic or consular agent of the infected country resident in the capital, and also to the International Sanitary Boards. It shall also communicate, through the same channels, the withdrawal of these measures or any modifications of them. In the absence of a diplomatic or consular agency in the capital, the communications shall be made direct to the Government of the country concerned.

SECTION II.—*Merchandise.—Disinfection.—Importation and Transit.—Baggage.*

Art. 11.—No article of merchandise is in itself capable of conveying plague or cholera. Merchandise becomes dangerous only when contaminated by plague or cholera products.

* "Isolation" means the isolation of the sick person, of those in permanent attendance on him, and the prohibition of visits by any other person.

APP. A, No. 1.

Translation of the International Sanitary Convention, 1903; by Dr. Theodore Thomson.

Art. 12.—Only such merchandise and things as the local sanitary authority considers infected may be subjected to disinfection. Provided always that the merchandise or things hereinafter specified may be subjected to disinfection or their importation may even be prohibited, irrespective of any evidence as to whether or not they are infected:—(1) Body-linen, wearing apparel, bedding that has been in use. But when these things are carried as baggage or in consequence of a change of abode (household goods), their importation may not be prohibited but they shall be dealt with as prescribed in Article 19. Soldiers' and sailors' kits, returned to their country after their death, are to be regarded as of the nature of the things specified in the first sentence of (1) of this Article. (2) Rags, save, in the case of cholera, rags compressed and carried in bound bales as merchandise in bulk. The importation of the following articles may not be prohibited:—Fresh waste derived directly from spinning, weaving, making up, or bleaching establishments; artificial wools (*Kunstwolle*, shoddy) and new paper clippings.

Art. 13.—The transit of the merchandise and things specified in (1) and (2) of the foregoing Article may not be prohibited if they are packed so that they cannot be manipulated on the way. Similarly, when such merchandise and things have been so conveyed that they cannot have come into contact with contaminated articles on the way, their transit through an infected local area must not hinder their importation into the country to which they are consigned.

Art. 14.—Importation of the merchandise and things specified in (1) and (2) of Article 12 shall not be prohibited if it be proved to the authority of the country to which they are consigned that they were despatched not less than five days before the commencement of the epidemic.

Art. 15.—It rests with the authority of the country to which the merchandise and things are consigned to decide in what manner and at what place disinfection shall be carried out, and what shall be the methods adopted to secure destruction of rats. These operations must be performed in such fashion as to injure articles as little as possible. It rests with each State to settle questions of consequent compensation for damage caused by measures of disinfection or of rat-destruction. If, on account of measures taken to secure destruction of rats on board ship, charges are levied by the sanitary authority either directly or indirectly through a company or a private person, the rates of these charges must be in accordance with a tariff made public beforehand, and so drawn up that the State or the sanitary authority shall, on the whole, derive no profit from its application.

Art. 16.—Letters and correspondence, printed matter, books, newspapers, business documents, &c. (not including parcels conveyed by post) shall not be subject to disinfection or to any restriction whatsoever.

Art. 17.—Merchandise, whether it has come by land or by sea, may not be detained at frontiers or at ports; the only measures that may be taken are those specified in the foregoing Article 12. Provided always that if merchandise, which has come by sea and is either not packed or imperfectly packed, has become infected during the voyage by rats ascertained to have plague, and if such merchandise cannot be disinfected, the destruction of the germs may be secured by storing the merchandise during a period not to exceed two weeks. It is to be understood that the application of this measure shall not in any way delay the ship nor give rise to extra expenses by reason of deficient storage-accommodation in any port.

Art. 18.—When merchandise has undergone disinfection in accordance with the provisions of Art. 12, or has been temporarily stored in virtue of the proviso contained in Art. 17, the proprietor of such merchandise or his representative has the right to exact from the sanitary authority that has ordered the disinfection or the storage, a certificate showing the measures that have been taken.

Art. 19.—*Baggage.*—Soiled linen, clothing and articles carried as baggage or as household goods, from a local area declared to be infected, shall undergo disinfection only in those instances where the sanitary authority considers them infected.

SECTION III.—*Measures at ports and land frontiers.*

Art. 20.—*Classification of ships.*—A ship shall be regarded as *infected* if there is plague or cholera on board or if there have been one or more cases of plague or cholera on board within seven days.

A ship shall be regarded as *suspected* if there have been cases of plague or cholera on board at the time of departure or during the voyage but no fresh case within seven days.

A ship shall be regarded as *healthy*, notwithstanding its having come from an infected port, if there has been no death from nor case of plague or cholera on board either before departure or during the voyage or on arrival.

Art. 21.—In the case of *plague, infected* ships shall undergo the following measures:—

(1) medical inspection;

(2) the sick shall immediately be disembarked and isolated;

(3) the other persons must also be disembarked if possible, and either be kept under observation* during a period which shall not exceed five days and which

* "Observation" means isolation of travellers either on board a ship or in a sanitary station before they obtain free pratique.

may or may not be followed by surveillance* of not more than five days' duration, or merely be subjected to surveillance during a period which shall not exceed ten days. The period shall date from the arrival of the ship. It rests with the sanitary authority of the port, after taking into consideration the date of the last case, the condition of the ship, and the local possibilities, to take that one of these measures which seems to them preferable;

(4) such soiled linen, wearing-apparel, and articles belonging to the crew† and passengers as are, in the opinion of the sanitary authority, infected shall be disinfected;

(5) the parts of the ship that have been occupied by persons ill with plague, or that, in the opinion of the sanitary authority, are infected, must be disinfected;

(6) the rats on board must be destroyel, either before or after discharge of cargo, as quickly as possible and, in any case, within a maximum time of forty-eight hours, and so as to avoid damage to merchandise and to the ship's plating and engines. In the case of ships in ballast, this process must be carried out as soon as possible before taking cargo.

Art. 22.—In the case of *plague, suspected* ships shall undergo the measures specified in (1), (4), and (5) of Article 21.

In addition, the crew and passengers may be subjected to surveillance, the duration of which, dating from the arrival of the ship, shall not exceed five days. The crew may, during the same period, be prevented from leaving the ship except on duty.

Destruction of rats on board is recommended. This process shall be carried out, either before or after discharge of cargo, as quickly as possible, and, in any case, within a maximum time of forty-eight hours, and so as to avoid damage to merchandise and to the ship's plating and engines. In the case of ships in ballast, this process, if there be occasion for it, shall be carried out as soon as possible, and, in any case, before taking cargo.

Art. 23.—In the case of *plague, healthy* ships shall be given free pratique immediately, whatever their bill of health may be. The only measures which the authority of the port of arrival may take as regards these ships are the following:—

(1) medical inspection;

* Surveillance means that travellers are not isolated; they receive free pratique immediately, but the authorities of the several places whither they are bound are informed of their coming, and they are subjected to medical examination with a view to ascertaining their state of health.

† "Crew" means persons forming or having formed part of the crew or staff of the ship, and includes stewards, waiters, cafedji, &c. The word must be interpreted in this sense in all instances in which it occurs in this Convention.

(2) disinfection of soiled linen, wearing-apparel and other articles belonging to the crew and passengers, but only in exceptional instances, when the sanitary authority has special reasons for regarding them as infected;

(3) the sanitary authority may subject ships from an infected port to a process intended to secure destruction of rats on board, either before or after discharge of cargo, although this measure must not be resorted to as a general rule. This process must be carried out as soon as possible and, in any case, must not take longer than twenty-four hours, and so as to avoid damage to merchandise and to the ship's plating and engines, and also so as not to interfere with the coming and going of passengers and crew between ship and shore. In the case of ships in ballast, the process, if there be occasion for it, shall be carried out as soon as possible and, in any case, before taking cargo.

If a ship from an infected port has been subjected to measures of rat-destruction, these cannot be repeated unless the ship has called at an infected port and has there brought up to the quay, or unless sick or dead rats are found on board.

The crew and passengers may be subjected to surveillance during a period which shall not exceed five days reckoned from the date on which the ship left the infected port. The crew may, during the same period, be prevented from leaving the ship except on duty.

The competent authority at the port of arrival may, in all cases, exact a certificate, given on oath, from the doctor of the ship, or, in his default, from the captain, testifying that there has not been a case of plague on board since departure and that unusual mortality among rats has not been observed.

Art. 24.—When rats on a *healthy* ship have been shown by bacteriological examination to have plague, or when unusual mortality among these rodents has been observed, the measures to adopt are as follows:—

I. Ships with rats having plague:—

(*a*) medical inspection;

(*b*) the rats must be destroyed, either before or after discharge of cargo, as quickly as possible and, in any case, within a maximum time of forty-eight hours, and so as to avoid damage to merchandise and to the ship's plating and engines. Ships in ballast shall undergo this process as soon as possible and, in any case, before taking cargo;

(*c*) such parts of the ship and such articles as the local sanitary authority regards as infected shall be disinfected;

(*d*) the passengers and crew may be subjected to surveillance during a period which must not exceed five days reckoned from the date of arrival, save in exceptional instances in which the sanitary authority may prolong the surveillance up to not more than ten days.

II. Ships on which unusual mortality among rats has been observed:—

(*a*) medical inspection;

(*b*) the rats shall be examined for plague as far and as quickly as possible;

(*c*) if it be considered necessary to destroy the rats, such destruction shall take place subject to the conditions specified above as regards ships with rats having plague;

(*d*) until all suspicion shall have been removed, the passengers and crew may be subjected to surveillance for a period which shall not exceed five days reckoned from the date of arrival, save in exceptional instances in which the sanitary authority may prolong the surveillance up to not more than ten days.

Art. 25.—The sanitary authority of the port shall, whenever requested, furnish the captain, the ship-owner, or the ship-owner's agent, with a certificate stating that measures of rat-destruction have been carried out, and giving the reasons why they were resorted to.

Art. 26.—In the case of *cholera, infected* ships shall undergo the following measures:—

(1) medical inspection;

(2) the sick shall be immediately disembarked and isolated;

(3) the other persons must also be disembarked, if possible, and either be kept under observation or subjected to surveillance during a period which shall vary with the health conditions of the ship and the date of the last case, but which shall not exceed five days reckoned from the arrival of the ship;

(4) such soiled linen, wearing-apparel, and articles belonging to the crew and passengers as are, in the opinion of the sanitary authority of the port, infected shall be disinfected;

(5) the parts of the ship that have been occupied by persons ill with cholera, or that the sanitary authority regard as infected, shall be disinfected;

(6) the bilge-water shall be disinfected and pumped out.

The sanitary authority may order that a supply of wholesome drinking-water be substituted for that stored on board.

Casting human excreta, or allowing them to pass, without preliminary disinfection, into the waters of the port may be prohibited.

Art. 27.—In the case of *cholera, suspected* ships shall undergo the measures prescribed in (1), (4), (5), and (6) of Article 26.

The crew and passengers may be subjected to surveillance during a period which must not exceed five days reckoned from the arrival of the ship. It is recommended that the crew be prevented, during the same period, from leaving the ship except on duty.

Art. 28.—In the case of *cholera, healthy* ships shall be given free pratique immediately, whatever their bill of health may be.

The only measures that the authority of the port of arrival may prescribe as regards these ships are those specified in (1), (4), and (6) of Article 26.

The crew and passengers may be subjected to surveillance, in respect of their state of health, during a period which must not exceed five days reckoned from the date on which the ship left the infected port. It is recommended that the crew be prevented, during the same period, from leaving the ship except on duty.

The competent authority at the port of arrival may, in all cases, exact a certificate, given on oath, from the doctor of the ship or, in his default, from the captain, testifying that there has not been a case of cholera on board since departure.

Art. 29.—In applying the measures specified in Articles 21-28, the fact of a ship of any of the three classes beforementioned carrying a doctor and disinfecting apparatus (disinfecting chambers) shall receive due consideration on the part of the competent authority. In the case of plague, like consideration shall be given when the ship is provided with apparatus for the destruction of rats.

The sanitary authorities of States that find it convenient to come to an agreement on the matter, may dispense with medical inspection and other measures in the case of healthy ships carrying a doctor specially commissioned by their country.

Art. 30.—Special measures may be prescribed as regards ships that are overcrowded, and more especially as regards emigrant ships, or any other ship in an unsanitary condition.

Art. 31.—Ships refusing to submit to measures prescribed by a port authority, in virtue of the provisions of this Convention, shall be at liberty to put out to sea. Such ships may be permitted to land goods after the following necessary precautions have been taken, viz.:—

(1) isolation of the ship, crew, and passengers;

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(2) in the case of plague, request for information as to whether there has been any unusual mortality among rats on board;

(3) in the case of cholera, disinfection and evacuation of the bilge-water and the substitution of wholesome drinking-water for that stored on board.

Such ships may also be authorised to disembark passengers at their request, on the condition that such passengers submit to the measures prescribed by the local authority.

Art. 32.—Ships from an infected place, that have been disinfected and have undergone adequate sanitary measures, shall not, on their arrival in another port, be subjected to these measures a second time, if no case has occurred since the disinfection was performed and if they have not called at an infected port. A ship which has merely disembarked passengers and their baggage, or mails, without having been in communication with the shore, shall not be regarded as having called at the port.

Art. 33.—Passengers arriving by an infected ship are entitled to exact from the sanitary authority of the port a certificate showing the date of their arrival and the measures taken as regards themselves and their baggage.

Art. 34.—Coasting traffic shall be dealt with by special regulations to be agreed upon by the countries concerned.

Art. 35.—Without prejudice to the right of Governments to agree to establish sanitary stations in common, every country must provide at least one port on each of its seaboards with an organisation and an equipment sufficient for the reception of a ship, whatever its health-conditions may be.

It is recommended that, when a healthy ship from an infected port arrives in a large sea-port, such ship should not be sent away to another port with a view to the carrying out of the sanitary measures prescribed.

In every country, the ports open to arrivals from ports infected with plague or cholera must be so equipped that healthy ships can there undergo the prescribed measures upon their arrival and be not sent to another port for the purpose. Governments shall make known what ports in their country are open to arrivals from ports infected with plague or cholera.

Art. 36.—It is recommended that there be provided in large sea-ports:—

(*a*) a properly-organised port medical service and permanent medical supervision of the health-conditions of crews and of the population of the port;

(*b*) suitable accommodation for the isolation of the sick and for keeping suspected persons under observation;

(*c*) bacteriological laboratories and the buildings and plant necessary for efficient disinfection;

(*d*) a supply of drinking water of quality above suspicion at the disposal of the port, and a system of scavenging that offers every possible guarantee for the removal of excrement and refuse.

SECTION IV.—*Measures at land frontiers.—Travellers.—Railways.—Frontier tracts.—Riverways.*

Art. 37.—Land quarantine must no longer be resorted to. Only such persons as show symptoms of plague or of cholera may be detained at frontiers.

This principle does not deprive a State of the right to close a portion of its frontiers in case of need.

Art. 38.—It is important that the railway staff keep watch over the state of health of travellers.

Art. 39.—Medical intervention shall be limited to inspection of travellers and care of the sick. When this inspection is resorted to, it shall, as far as possible, be combined with the Customs' examination in order that travellers may suffer as little delay as possible. Only those persons who are visibly ailing shall be subjected to a thorough medical examination.

Art. 40.—It is a measure of the greatest value to subject travellers that have come from an infected place, on their arrival at their destination, to surveillance for a period which should not exceed ten or five days, reckoned from the date of their departure, in the case of plague or cholera respectively.

Art. 41.—Governments have the right reserved to them of taking special measures in regard of certain classes of persons, notably gipsies, vagrants, emigrants, and persons travelling or crossing the frontier in bands.

Art. 42.—Railway-carriages for passengers, mails, or luggage may not be detained at a frontier. If one of these carriages be infected or shall have been occupied by a person suffering from plague or from cholera, it shall be detached from the train for disinfection at the earliest possible moment. The same procedure shall apply in the case of goods trucks.

Art. 43.—Measures in relation with the crossing of frontiers by railway and postal staff come within the scope of the administrations concerned. They shall be arranged so as not to hamper the service.

Art. 44.—The regulation of frontier traffic and questions connected therewith, as also the adoption of exceptional measures of surveillance, must be left as matters for special arrangement between adjoining States.

Art. 45.—The sanitary control of river-ways is a matter for special arrangement by the Governments of States abutting thereon.

PART II.

Special Provisions regarding Countries outside Europe.

CHAPTER I.

Arrivals by Sea.

SECTION I.—*Measures at infected ports on the departure of vessels.*

Art. 46.—The competent authority shall take effectual measures to prevent the embarkation of persons showing symptoms of plague or of cholera.

Every person taking passage by a ship must be individually examined at the time of embarkation, by day and on shore, during such time as may be necessary, by a doctor appointed by the public authority. The consular authority of the country to which the ship belongs may be represented at this examination.

In exception of this provision, the medical examination may, at Alexandria and Port Said, take place on board whenever the local sanitary authority consider this course to be of service; subject, however, to the reservation that third-class passengers shall not afterwards be authorised to leave the ship. The medical examination may be conducted by night in the case of first-class and second-class passengers, but not in the case of third-class passengers.

Art. 47.—The competent authority shall take effectual measures:—

(1) to prevent the exportation of such merchandise or articles of any sort as it may regard as infected and which have not previously been disinfected on shore under the supervision of a doctor appointed by the public authority;

(2) in the case of plague, to prevent rats gaining access to ships;

(3) in the case of cholera, to see that drinking-water taken on board is wholesome.

SECTION II.—*Measures regarding ordinary ships from infected northern ports, on their arrival at the entrance to the Suez Canal or at Egyptian ports.*

Art. 48.—Ordinary *healthy* ships from a port, infected with plague or with cholera, in Europe or in the Mediterranean basin, proposing to pass through the Suez Canal, shall be

granted passage in quarantine and shall continue their voyage under five days' observation.

Art. 49.—Ordinary *healthy* ships, wishing to touch at Egypt, may put in at Alexandria or Port Said, where their passengers shall complete the period of five days' observation, either on board, or in a sanitary station, as the local sanitary authority may decide.

Art. 50.—The measures to be taken as regards *infected* and *suspected* ships from a European or Mediterranean port infected with plague or with cholera, wishing to touch at an Egyptian port or to pass through the Suez Canal, shall be settled by the Egyptian Sanitary Board in conformity with the provisions of this Convention. The regulations embodying these measures must, to become effective, be accepted by the several Powers represented on the Board: they shall establish the measures to which ships, passengers, and merchandise are to be subjected, and must be submitted with the least possible delay.

SECTION III.—*Measures in the Red Sea.*

A.—*Measures regarding ordinary ships from the South, touching at Red Sea ports or bound for the Mediterranean.*

Art. 51.—In addition to the general provisions comprised in Part I., Chapter II., Section III., concerning the classification of ships as infected, suspected, or healthy, and the measures regarding them, the special provisions, embodied in the following articles, shall apply to ordinary ships entering the Red Sea from the south.

Art. 52.—*Healthy* ships must have completed or must complete five full days' observation reckoned from the time of their departure from the last infected port touched at.

They shall be entitled to pass through the Suez Canal in quarantine and shall enter the Mediterranean continuing the above-mentioned five days' observation. Ships with a doctor and a disinfecting chamber shall not undergo disinfection prior to the passage in quarantine.

Art. 53.—*Suspected* ships shall be treated in a manner which shall differ according as to whether they have or have not a doctor and a disinfecting apparatus (disinfecting chamber).

(*a.*) Those that have a doctor and a disinfecting apparatus (disinfecting chamber) that fulfils the requisite conditions shall be allowed to pass through the Suez Canal in quarantine subject to the regulations prescribed for the passage.

(*b.*) Those that have neither doctor nor disinfecting apparatus (disinfecting chamber) shall, before being allowed to pass through the Canal in quarantine, be detained at Suez or at Moses' Wells for such time as may be necessary for the ver-

formance of the disinfection prescribed and for assurance that the health conditions on board are satisfactory.

Passage in quarantine shall be granted to mail-boats or packets specially devoted to passenger traffic that have a doctor but no disinfecting apparatus (disinfecting chamber), if it be officially established to the satisfaction of the local authority that cleansing and disinfection have been properly carried out at the place of departure or during the voyage.

Free pratique may be granted at Suez, on the termination of the procedure prescribed by the regulations, to mail-boats or packets specially devoted to passenger traffic that have a doctor but no disinfecting apparatus (disinfecting chamber) if the last case of plague or cholera occurred more than seven days before and if the health-conditions of the ship are satisfactory.

In the case of a vessel that has had a healthy voyage of less than seven days' duration, passengers for Egypt shall be landed at an establishment appointed by the Alexandria Board and isolated for such time as may be necessary for the completion of five days' observation. Their soiled linen and their wearing apparel shall be disinfected. They shall then be granted free pratique.

Ships that have had a healthy voyage of less than seven days' duration and that wish to have free pratique for Egypt shall be detained at an establishment, appointed by the Alexandria Board, during such time as may be necessary for the completion of five days' observation; they shall undergo the measures prescribed by the regulations for suspected vessels.

When plague or cholera has occurred among the crew only, no soiled linen shall be disinfected save that of the crew, the whole of which, however, shall undergo disinfection; the crew's quarters shall also be disinfected.

Art. 54.—*Infected* ships shall be divided into two classes, ships with a doctor and a disinfecting apparatus (disinfecting chamber), and ships without a doctor and without a disinfecting apparatus (disinfecting chamber).

(*a*) Ships without a doctor and without a disinfecting apparatus (disinfecting chamber) shall be detained at Moses' Wells;* persons that show symptoms of plague or cholera shall be disembarked and isolated in a hospital. Disinfection shall be thoroughly carried out. The other persons shall be disembarked and isolated in as small groups as possible so that, if plague or cholera break out in one group, the whole party will not be affected. The soiled linen and the clothing of passengers and crew, and other articles used by them, shall be disinfected, as also shall the ship.

It is to be understood that there is no question of discharging merchandise, but only of disinfecting the infected part of the ship.

* The sick shall, as far as possible, be landed at Moses' Wells; the other persons may be kept under observation at a sanitary station appointed by the Egyptian Sanitary Maritime and Quarantine Board (pilots' lazaret).

The passengers shall remain five days at an establishment appointed by the Egyptian Sanitary Maritime and Quarantine Board. When cases of plague and cholera have not occurred for several days the term of isolation shall be shortened. Its duration shall vary according to the date of recovery, death, or isolation of the last case. Thus, if six days have elapsed since the recovery, death, or isolation of the last case, the period of observation shall be one day; if only five days have elapsed, the period shall be two days; if only four days have elapsed, the period shall be three days; if only three days have elapsed, the period shall be four days; if only two days or one day have elapsed, the period shall be five days.

(*b*) Ships with a doctor and a disinfecting apparatus (disinfecting chamber) shall be detained at Moses' Wells. The ship's doctor must state, on oath, which persons on board have symptoms of plague or of cholera. These persons shall be disembarked and isolated.

After these persons have been disembarked, such of the soiled linen of the other passengers as the sanitary authority regards as dangerous and that of the crew shall be disinfected on board. When plague or cholera has occurred only among the crew, the disinfection of linen shall be carried out only as regards the soiled linen of the crew and the linen of the crew's quarters.

The ship's doctor must also declare, on oath, which part or compartment of the ship was occupied by the sick and to which section of the hospital they were removed. He must also declare, on oath, which persons have been in relation with the plague or cholera patient since the first appearance of the disease, either by direct contact or by contact with objects that may have been infected. Only these persons shall be regarded as suspected.

The part or compartment of the ship, and the section of the hospital, that have been occupied by the sick, shall be thoroughly disinfected. "Part of the ship" shall mean the cabin of the sick person, the adjoining cabins, the passage to these cabins, the deck, the parts of the deck where the sick person or persons have remained for some time. If it be impossible to disinfect the part or compartment of the ship that has been occupied by plague or cholera sick without disembarking the persons declared to be suspected, these persons shall either be transferred to another ship specially reserved for the purpose, or be landed and accommodated in the sanitary station without being brought into contact with the sick, who must be kept in the hospital. This stay on board ship or on shore, for purposes of disinfection, shall be as short as possible and shall not exceed twenty-four hours.

The suspected persons shall be kept under observation, either on their own ship or on the ship reserved for that purpose, for a period which shall vary according to the circumstances and in the manner set out in the third paragraph of sub-section (*a*) of this article.

The time occupied in carrying out the measures prescribed by the regulations shall be included in the observation period.

Passage in quarantine may, if deemed possible by the sanitary authority, be allowed before expiry of the periods of detention indicated above. It shall in any case be granted on the completion of disinfection if the ship leaves behind, in addition to its sick, the persons classed above as "suspected."

A barge fitted with a disinfecting chamber may be brought alongside the ship with a view to hastening the process of disinfection.

Infected vessels seeking free pratique in Egypt shall be detained five days at Moses' Wells; they shall, in addition, undergo the same measures as are taken in the case of infected ships arriving in Europe.

B.—*Measures regarding ordinary ships from infected ports in the Hedjaz during the pilgrimage season.*

Art. 55.—If, during the Mecca pilgrimage, plague or cholera is prevalent in the Hedjaz, ships from the Hedjaz or from any other part of the Arabian coast of the Red Sea, that have not there taken on board any pilgrims or like collections of persons and on which there has been no suspicious incident during the voyage, shall be classed as ordinary suspected ships and shall be subjected to the preventive measures and the treatment prescribed for such ships.

If they are bound for Egypt they shall undergo, at a sanitary station appointed by the Sanitary Maritime and Quarantine Board, five days' observation, reckoned from the date of their departure, whether it be cholera or plague that is in question. They shall, moreover, be subjected to all the measures prescribed for suspected ships (disinfection, &c.), and shall not be granted free pratique until after favourable medical inspection.

It is to be understood that, if there have been suspicious incidents on board during the voyage, the period of observation shall be undergone at Moses' Wells and shall be five days whether it be cholera or plague that is in question.

SECTION IV.—*The organisation for securing surveillance and disinfection at Suez and at Moses' Wells.*

Art. 56.—Every ship arriving at Suez shall undergo the medical inspection prescribed by the regulations. This inspection shall be conducted by one or more of the doctors attached to the station, and shall, in the case of ships from a port infected with plague or with cholera, be made by day. It may, however, in the case of ships wishing to pass through the Canal, take place by night when the ship is lighted by electricity and

in all cases in which the local sanitary authority is satisfied that the ship is sufficiently well lighted.

Art. A. No. — Translation of the International Sanitary Convention, 1903; by Dr. Theodore Thomson.

Art. 57.—There shall be at least seven doctors at the Suez station,—a principal medical officer and six medical officers. They must hold a recognised diploma and, in their selection, preference is to be given to medical men who have made a special study of practical epidemiology and practical bacteriology. They shall be appointed by the Minister of the Interior on the recommendation of the Sanitary Maritime and Quarantine Board of Egypt. The salary of the medical officers shall commence at 8,000 francs and rise by progressive increments to 12,000 francs; that of the principal medical officer shall commence at 12,000 francs and rise to 15,000 francs.

Should this medical staff prove insufficient, naval doctors of the several States may be employed, under the orders of the Principal Medical Officer of the sanitary station.

Art. 58.—The supervision and performance of the Suez Canal prophylactic measures, at the Moses' Wells and Tor stations, shall be entrusted to a staff of sanitary guards.

Art. 59.—This staff shall consist of ten guards. They shall be selected from retired non-commissioned officers, of higher than corporal's rank, of the armies and navies of Europe and Egypt. These guards are elected, after the Board is satisfied as to their fitness, according to the procedure laid down in Article 14 of the Khedivial Decree of 19th June, 1893.

Art. 60.—There shall be two classes of guards; four of the first class, six of the second class.

Art. 61.—The yearly pay of these guards shall be £160 Egyptian, rising by progressive increments to a maximum of £200 Egyptian, for the first class; and £120 Egyptian rising, by progressive increments to a maximum of £168 Egyptian, for the second class.

Art. 62.—These guards shall have the status of police officers with the right to invoke aid in cases where the sanitary regulations are infringed. They shall be under the immediate control of the administrator-in-chief of the establishment at Suez or Tor. They must have practical knowledge of all the methods of disinfection in use and must know how to manipulate disinfecting materials and apparatus.

Art. 63.—The disinfecting and isolation station at Moses' Wells shall be under the control of the principal medical officer at Suez. If sick persons are landed at the Moses' Wells Station, two of the Suez medical officers shall be kept in residence there, one to attend to cases of plague or cholera the other to attend to persons not suffering from these diseases. If there should be cases of plague, of cholera, and of other diseases at the same time, three medical officers shall be kept in residence; one for plague cases, one for cholera cases, and the third for persons suffering from other diseases.

Art. 64.—The disinfecting and isolation station at Moses' Wells must be provided with:—

(1) at least three disinfecting chambers, of which one shall be on a barge, and the plant required for rat-destruction;

(2) two isolation hospitals, each with twelve beds, one for cases of plague and persons suspected of having plague, the other for cases of cholera and persons suspected of having cholera. These hospitals must be so arranged that, in each of them, the sick, the suspected, and men and women can be segregated from one another;

(3) buildings, hospital-tents, and ordinary tents, for the accommodation of persons landed;

(4) a sufficient number of baths and shower-baths;

(5) the necessary buildings for general staff, doctors, guards, &c.; a store and a laundry;

(6) a reservoir for the water-supply;

(7) the several buildings must be so arranged that the sick, or infected or suspected articles, cannot be brought into contact with other persons.

Art. 65.—The disinfecting chambers at Moses' Wells shall be entrusted to the special care of a skilled mechanic.

SECTION V.—*The passage of the Suez Canal in quarantine.*

Art. 66.—Permission to pass the Suez Canal in quarantine shall be granted by the Suez sanitary authority; the Board shall be immediately informed when such permission is given. In doubtful cases, the decision shall rest with the Board.

Art. 67.—When the permission provided for in the preceding article has been given, a telegram shall at once be sent to the authority appointed by each Power. The telegram shall be sent at the expense of the ship.

Art. 68.—Each Power shall issue an edict subjecting to penalties those vessels which depart from the course declared by the captain and enter without license one of the ports of that Power. Exception shall be made in the case of circumstances beyond control and when a break in the voyage cannot be avoided.

Art. 69.—When the health-visit takes place, the captain must declare if he has on board gangs of native stokers, or hired servants, of any description, not included in the roll of the crew, or the register kept for the purpose. The following questions, in particular, shall be put to the captains of all ships

arriving at Suez from the south and shall be answered by them on oath:—

Have you any supernumeraries: stokers, or other hands not included in the ship's roll or in the special register?

What is their nationality?

Where did you embark them?

The medical officers must satisfy themselves as to the presence of these supernumeraries, and if they find that any of their number are missing, they must inquire carefully into the cause of their absence.

Art. 70.—A sanitary officer and two sanitary guards shall go on board. They must accompany the ship as far as Port Said; their duty is to prevent communication, and to see to the execution of the measures prescribed for the passage of the Canal.

Art. 71.—All embarkation and disembarkation, and all transhipment of passengers or goods, are forbidden during the passage of the Canal from Suez to Port Said.

Provided always that travellers may embark at Port Said in quarantine.

Art. 72.—Ships passing through the Canal in quarantine must make the journey from Suez to Port Said without lying up.

In the case of the vessel running aground, or being compelled to lie up, the necessary operations shall be carried out by the staff of the ship, all communication with the staff of the Suez Canal Company being avoided.

Art. 73.—Infected or suspected transports passing through the Canal in quarantine with troops must do so only by day. If they are compelled to pass the night in the Canal, they shall anchor in Lake Timsah or in the Great Lake.

Art. 74.—Ships that pass through the Canal in quarantine are forbidden to stop at Port Said except as provided for by the second paragraph of Article 71 and by Article 75. Revictualling must be effected by the means at the disposal of the ship. All stevedores and others who have gone on board shall be isolated on the quarantine barge, where their clothing shall be disinfected as prescribed by the regulations.

Art. 75.—When it is absolutely necessary for ships passing in quarantine to coal at Port Said, they must do so at a place to be fixed by the Sanitary Board, where the necessary isolation and sanitary supervision can be secured. The coaling may be done by the labourers of the port in cases where effective supervision of this operation is possible, and when all contact with the crew can be avoided. At night, the coaling-place must be lighted by electricity.

Art. 76.—Pilots, electricians, agents of the Company, and sanitary guards shall be disembarked at Port Said outside the port, between the jetties, and shall be taken thence direct to the quarantine-barge, where their clothing shall be disinfected if necessary.

Art. 77.—As regards the passage of the Suez Canal, the following advantages shall be accorded to ships of war as hereinafter specified.

The quarantine authority shall accept them as healthy on their presenting a certificate signed by the ship-surgeons, countersigned by the captain, and stating on oath:—

(*a*) that there has not been, either at the time of departure or during the voyage, a case of plague or of cholera on board;

(*b*) that a careful examination of every one on board, without exception, has been made within 12 hours of arrival at the Egyptian port, and that no case of either of these diseases has been detected.

These ships shall not undergo medical inspection, and shall be given free pratique at once subject to their having completed five clear days since leaving the last infected port at which they called. Such of these ships as have not completed the requisite period may pass through the canal in quarantine without medical inspection provided they produce the certificate above mentioned to the quarantine authority.

Notwithstanding the foregoing provisions, the quarantine authority shall have the right of medically inspecting, by its officers, ships of war in all instances in which it considers this procedure necessary.

Infected or suspected ships of war shall be subject to the regulations in force.

Only fighting-units shall be regarded as ships of war. Transports and hospital-ships shall be classed as ordinary ships.

Art. 78.—The Egyptian Maritime and Quarantine Board may arrange the conveyance, by rail, over Egyptian territory, of mails and ordinary passengers from infected countries in quarantine trains, under the conditions specified in Appendix No. 1.

SECTION VI.—*Measures in the Persian Gulf.*

Art. 79.—Ships shall undergo the health-visit at the Island of Ormuz sanitary station before they enter the Persian Gulf. They shall undergo the measures specified in Section III., Chapter II., Part I., that their health-conditions and the place whence they have come render applicable. Ships, however, that have to proceed up the Shatt-el-Arab shall be permitted, if the period of observation has not been completed, to con-

tinue their voyage, on condition that they traverse the Persian Gulf and the Shatt-el-Arab in quarantine. A chief guard and two sanitary guards, taken on board at Ormuz, shall keep the ship under supervision as far as Bassorah, where a second medical inspection shall be made and the necessary measures of disinfection carried out. Pending the organisation of the Ormuz sanitary station, the sanitary guards shall be taken on at the temporary station provided in accordance with paragraph 2 of Article 82 hereinafter, and these guards shall accompany ships proceeding in quarantine up the Shatt-el-Arab to the station provided in the neighbourhood of Bassorah.

Ships that have to call at Persian ports to disembark passengers or goods may do so at Bender-Bushire.

It is to be clearly understood that a ship which continues healthy after five days, reckoned from her date of departure from the last port infected by plague or cholera at which she has touched, shall be granted free pratique at Persian Gulf ports, provided she is ascertained to be healthy on arrival.

Art. 80.—In so far as the classification of ships and the measures they are to undergo are concerned, Articles 20 to 28 of this Convention apply in the Persian Gulf, subject to the three following modifications:—

(1) observation, for the same period, shall always be substituted for surveillance of passengers and crew;

(2) healthy ships cannot be granted free pratique unless they have completed five full days since leaving the last infected port at which they have touched;

(3) in the case of suspected ships the periods of five days' observation of passengers and crew shall be reckoned from the time at which there ceased to be a case of plague or of cholera on board.

SECTION VII.—*Persian Gulf Sanitary Stations.*

Art. 81.—Sanitary stations must be provided, under the direction and at the expense of the Constantinople Board of Health, one at the Island of Ormuz, the other at a spot to be selected in the neighbourhood of Bassorah.

At the Ormuz sanitary station there shall be at least two doctors, sanitary officers, sanitary guards, and a complete plant for disinfection and for destruction of rats. A small hospital shall be erected.

At the station near Bassorah there shall be provided a large lazaret with a staff of several doctors, and buildings and plant for the disinfection of goods.

Art. 82.—The Constantinople Superior Board of Health, which has the control of the Bassorah sanitary station, shall have the same power as regards the Ormuz station.

Pending the construction of the Ormuz sanitary station, a sanitary post shall be provided there by the Constantinople Superior Board of Health.

CHAPTER II.

ARRIVALS BY LAND.

SECTION I.—*General provisions.*

Art. 83.—The measures taken in respect of arrivals by land from districts infected with plague or with cholera must be in conformity with the sanitary principles laid down in this Convention.

Modern methods of disinfection must be substituted for land quarantine. With this object, disinfecting chambers and other disinfecting plant shall be established at properly selected points on the roads frequented by travellers. The same methods shall be adopted on railways, whether now in existence or constructed hereafter. Merchandise shall be disinfected in accordance with the principles of this Convention.

Art. 84.—Every Government is at liberty, in case of need, to close a portion of its frontiers to passengers and merchandise in localities where there is difficulty in organising sanitary supervision.

SECTION II.—*Turkish land frontiers.*

Art. 85.—The Constantinople Superior Board of Health must organise without delay the sanitary stations of Hanikin and Kisil Dizié, near Bayazid, on the Turco-Persian and Turco-Russian frontiers.

PART III.

Special Provisions regarding Pilgrimages.

CHAPTER I.

GENERAL PROVISIONS.

Art. 86.—The provisions of Articles 46 and 47, Part II., are applicable to persons and things that have to be taken on board a pilgrim-ship leaving a port in the Indian Ocean or

Oceania, even when the port is not infected with plague or with cholera.

Art. 87.—When there are cases of plague or of cholera in the port, embarkation on pilgrim-ships shall not take place until the persons, collected in groups, shall have been subjected to observation sufficient to ensure that none of them are suffering from plague or cholera. It is to be understood that, as regards the adoption of this measure, every Government may take local circumstances and possibilities into account.

Art. 88.—If local circumstances permit, pilgrims must prove that they possess the means absolutely necessary for the accomplishment of the pilgrimage, and, in particular, that they have a return-ticket.

Art. 89.—Only steamships shall be permitted to carry pilgrims on long voyages. The carriage of pilgrims by other ships on such voyages shall be prohibited.

Art. 90.—Pilgrim-ships that are coasters intended for short passages known as "coasting voyages" shall be subject to the provisions of the special regulations for the Hedjaz pilgrimage, which shall be published by the Constantinople Board of Health, in conformity with the principles laid down in this Convention.

Art. 91.—A ship which, in addition to ordinary passengers, among whom pilgrims of the upper classes may be included, carries pilgrims of the lowest class in less proportion than one pilgrim per 100 tons gross, shall not be considered a pilgrim-ship.

Art. 92.—Every pilgrim-ship, on entering the Red Sea or the Persian Gulf, must observe the provisions of the special regulations for the Hedjaz pilgrimage, which shall be published by the Constantinople Board of Health, in conformity with the principles laid down in this Convention.

Art. 93.—The captain must pay all sanitary imposts leviable on pilgrims. These imposts must be covered by the price of the ticket.

Art. 94.—As far as practicable, pilgrims who embark or disembark at sanitary stations must have no contact with one another at the landing-places.

Ships that have disembarked their pilgrims must change their anchorage before commencing re-embarkation.

Pilgrims who have been disembarked must be distributed in camp in as small groups as possible. It is necessary that they be supplied with wholesome drinking-water, obtained either from local sources or by distillation.

Art. 95.—When there is plague or cholera in the Hedjaz, provisions brought by pilgrims shall be destroyed if the sanitary authority consider it necessary.

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CHAPTER II.

Pilgrim Ships.—Sanitary Stations.

Section I.—*General conditions applying to ships.*

Art. 96.—The ship must be capable of accommodating the pilgrims in the between-decks.

Over and above the space required for the crew, the ship must provide for each person, irrespective of age, an area of 1·50 square metres, equivalent to 16 English square feet, and a height between decks of about 1·80 metres. In coasting vessels, each pilgrim must be allowed a space at least 2 metres wide along the gunwales.

Art. 97.—On each side of the ship, on deck, a place must be set apart, screened from view and furnished with a hand-pump, for the supply of sea-water for the needs of the pilgrims. One such place must be reserved exclusively for women.

Art. 98.—The ship must be provided, in addition to closets for the crew, with latrines, fitted with a flushing apparatus or with a water tap, in a minimum proportion of one latrine per hundred passengers. Some of these latrines shall be reserved exclusively for women.

There must be no closets between decks or in the hold.

Art. 99.—The ship must have two places for cooking set apart for the use of the pilgrims. Pilgrims shall be forbidden to light fires elsewhere, especially on deck.

Art. 100.—A properly fitted hospital, constructed with due attention to safety and health, must be reserved for the accommodation of the sick. It must be capable of accommodating, at the rate of three square metres per patient, not less than five per cent. of the pilgrims taken on board.

Art. 101.—The ship must be provided with the means of segregating persons showing symptoms of plague or of cholera.

Art. 102.—Every ship must carry such medical remedies, disinfectants, and things as are necessary for the treatment of the sick. The regulations framed for this class of ship by each Government must specify the nature and the quantity of these remedies.* Medicine and attendance shall be provided for the pilgrims free of charge.

Art. 103.—Every ship taking pilgrims must carry a duly qualified doctor, commissioned by the Government of the country to which the ship belongs or by the Government of the port where the pilgrims are embarked. A second doctor must be carried when the number of pilgrims on board exceeds 1,000.

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* It is to be desired that every ship be provided with the chief immunising agents (anti-plague serum, Haffkine's prophylactic, &c.).

Art. 104.—The captain must cause notices, in the languages chiefly spoken in the countries inhabited by the pilgrims he is taking, to be posted up on the ship in a conspicuous place, accessible to all concerned, showing:—

(1) the destination of the ship;

(2) the price of tickets;

(3) the daily ration of food and water allowed to each pilgrim;

(4) the price of articles, not included in the daily ration, which may be procured on extra payment.

Art. 105.—The heavy baggage of pilgrims shall be registered, numbered, and put in the hold. Pilgrims may keep with them only such things as are absolutely necessary. The nature, amount, and dimensions of these things shall be decided by regulations framed by each Government for its own ships.

Art. 106.—The provisions of Chapter I., of Sections I., II., and III. of Chapter II., and of Chapter III., of Part III. of this Convention shall be posted up, in the form of regulations, in the language of the country to which the ship belongs, and also in the languages chiefly spoken in the countries inhabited by the pilgrims to be embarked, in a conspicuous and accessible place on every deck and between-decks of every ship carrying pilgrims.

SECTION II.—*Measures before departure.*

Art. 107.—The captain or, in his default, the owner or agent of every pilgrim-ship must, not less than three days before departure, declare to the competent authority of the port of departure his intention to embark pilgrims. At ports of call, the captain or, in his default, the owner or agent of every pilgrim-ship must make the same declaration twelve hours before the departure of the ship. This declaration must specify the proposed date of departure and the destination of the ship.

Art. 108.—On receipt of the declaration provided for by the preceding article the competent authority shall proceed, at the expense of the captain, to inspect and measure the ship. The consular authority of the country to which the ship belongs may be present at this inspection. Inspection alone shall take place if the captain already has a certificate of measurement furnished by the competent authority of his country, unless it be suspected that the certificate no longer represents correctly the real condition of the ship.*

* At present the competent authority is: in British India, an officer appointed for the purpose by the Local Government (Native Passengers' Ships Act, 1877, Article 7); in the Dutch Indies, the master of the port; in Turkey, the sanitary authority; in Austro-Hungary, the port authority; in Italy, the captain of the port; in France, Tunis, and Spain, the sanitary authority; in Egypt, the sanitary quarantine authority.

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Art. 109.—The competent authority shall not permit the departure of a pilgrim-ship until satisfied:—

(*a*) that the ship has been thoroughly cleaned and, if necessary, disinfected;

(*b*) that the ship is in a condition to undertake the voyage without danger, that she is properly manned, equipped and ventilated, and provided with a sufficient number of boats; that there is on board nothing that is, or may become, injurious to the health or safety of the passengers, and that the deck is of wood or of iron sheathed in wood;

(*c*) that there is on board, properly stowed away, over and above the rations for the crew, sufficient food and fuel of good quality for all the pilgrims, during the declared duration of the voyage;

(*d*) that the drinking-water is of good quality and from a source free from risk of contamination; that it is in sufficient quantity; that the tanks for drinking-water are safe from all contamination and so closed that the water can be supplied only by means of taps or pumps. The water-supply fittings known as "suçoirs" shall be absolutely prohibited;

(*e*) that the vessel carries a condenser, capable of distilling a minimum quantity of five litres of water per diem for every person on board, including crew;

(*f*) that the ship possesses a disinfecting chamber, ascertained by the sanitary authority of the port where the pilgrims embarked to be safe and efficacious;

(*g*) that, in accordance with Articles 102 and 103, the vessel carries a duly qualified doctor commissioned* either by the Government of the country to which she belongs or by the Government of the port where the pilgrims embark, and that she carries medical stores;

(*h*) that the deck is free from merchandise and all encumbrances;

(*i*) that the arrangements on board are such as to allow of the measures prescribed in the following Section III. being carried out.

Art. 110.—The captain may not start without having in his possession:—

(1) a list, countersigned by the competent authority, showing the name, sex, and total number of pilgrims he is authorised to carry;

(2) a bill-of-health, giving the name, nationality, and tonnage of the ship, the name of the captain and of the

* Exception is made in the case of Governments without commissioned doctors.

doctor, the exact number of persons embarked—crew, pilgrims and other passengers—the nature of the cargo and the place of departure.

The competent authority shall note on the bill-of-health whether the number of pilgrims permissible under the regulations has been embarked or not, and, in the latter case, the additional number of passengers the vessel is authorised to embark at subsequent ports of call.

SECTION III.—*Measures during the voyage.*

Art. 111.—During the voyage the deck must be kept free from encumbrances; it must be reserved, night and day, for the passengers, and placed at their disposal without charge.

Art. 112.—The between-decks must be carefully cleansed and rubbed with dry sand, mixed with disinfectants, every day while the pilgrims are on deck.

Art. 113.—The latrines allotted to the passengers, as well as those for the crew, must be kept clean, and must be cleansed and disinfected three times a day.

Art. 114.—The excretions and dejecta of persons showing symptoms of plague or of cholera must be received in vessels containing a disinfecting solution. These vessels shall be emptied into the latrines, which must be thoroughly disinfected every time this is done.

Art. 115.—All bedding, carpets, and clothing that have been in contact with the sick persons referred to in the preceding Article must be immediately disinfected. The observance of this rule is specially enjoined in respect of the clothes of persons who have been near the sick, and which may have been contaminated. Such of the above-mentioned articles as are of no value must be either thrown overboard, if the ship is not in harbour or in a canal, or else burnt. Other articles must be carried to the disinfecting chamber in impermeable bags washed in a disinfecting solution.

Art. 116.—The quarters occupied by the sick, referred to in Article 100, must be thoroughly disinfected.

Art. 117.—It is compulsory on pilgrim-ships to undergo such measures of disinfection as are in accordance with the regulations on this subject that are, for the time being, in force in the country under whose flag they sail.

Art. 118.—Not less than five litres of drinking-water must each day be put at the disposal of every pilgrim, irrespective of age, free of charge.

Art. 119.—If there be any doubt as to the quality of the drinking-water or any reason to suspect that it may possibly have become contaminated, either at its source or during the voyage, it must be boiled or otherwise sterilised, and the

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captain shall be responsible for seeing that it is thrown overboard at the first port of call at which he can procure a purer supply.

Art. 120.—The doctor shall visit the pilgrims, tend the sick, and see that the principles of hygiene are observed on board. He must in particular:—

(1) satisfy himself that the rations issued to the pilgrims are of good quality, that their quantity is in accordance with contract, and that they are properly prepared;

(2) satisfy himself that the provisions of Article 118, regarding the distribution of water, are observed;

(3) if there be any doubt as to the quality of the drinking-water, call the attention of the captain, in writing, to the provisions of Article 119;

(4) satisfy himself that the ship is always kept clean, and particularly that the latrines are cleansed in accordance with the provisions of Article 113;

(5) satisfy himself that the pilgrims' quarters are kept wholesome, and, in case of the occurrence of infectious disease, that disinfection is carried out in accordance with Articles 116 and 117:

(6) keep a diary of all occurrences related to health during the voyage, and submit this diary to the competent authority at the port of arrival.

Art. 121.—Only the persons charged with the care of plague or cholera patients shall have access to them, and these persons must not come in contact with the other persons that have been embarked.

Art. 122.—In the event of a death occurring during the voyage, the captain must enter the fact opposite the name of the deceased, on the list countersigned by the authority of the port of departure, and must also enter in the log the name of the deceased, his age, the place from which he came, the supposed cause of death according to the medical certificate, and the date of death.

In the event of a death from infectious disease, the corpse, wrapped in a shroud impregnated with a disinfecting solution, must be committed to the deep.

Art. 123.—The captain must see that all preventive measures taken during the voyage are entered in the log. The log shall be submitted by him to the competent authority at the port of arrival.

At each port of call the captain must cause the list drawn up in accordance with Article 110 to be countersigned by the competent authority.

In the event of a pilgrim disembarking during the voyage, the captain must note the fact on the list opposite the pilgrim's name.

In the event of persons embarking, their names must be entered on the list in accordance with the foregoing Article 110. This must be done before the competent authority, as in duty bound, again countersigns the list.

Art. 124.—The bill-of-health given at the port of departure must not be changed during the voyage.

It shall be countersigned at each port of call by the sanitary authority, who shall enter:—

(1) the number of passengers disembarked or embarked at the port;

(2) anything that has happened at sea affecting the life or health of the persons embarked;

(3) the health conditions of the port of call.

SECTION IV.—*Measures on arrival of pilgrims in the Red Sea.*

A. *Sanitary control of ships from an infected port, going from the south to the Hedjaz with Mohammedan pilgrims.*

Art. 125.—Pilgrim-ships from the south, bound for the Hedjaz, must, in the first instance, put in at the Kamaran sanitary station, and shall be dealt with as provided by Articles 126-128.

Art. 126.—Ships found, on medical inspection, to be *healthy* shall be given free pratique on completion of the following procedure:—

The pilgrims shall be disembarked; they shall take a shower bath or bathe in the sea; their soiled linen and any portion of their personal effects or their baggage, open, in the opinion of the sanitary authority, to suspicion, shall be disinfected. The duration of these operations, including disembarkation and embarkation, must not exceed forty-eight hours.

If no recognised or suspected case of plague or of cholera be discovered during these operations, the pilgrims shall immediately be re-embarked and the ship shall proceed to the Hedjaz.

In the case of plague, the provisions of Articles 23 and 24 regarding rats shall apply in the event of there being any of these vermin on board.

Art. 127.—*Suspected* ships, which have had cases of plague or of cholera on board at the time of departure, but no fresh case of plague or of cholera within seven days, shall be dealt with as follows:—

The pilgrims shall be disembarked; they shall take a shower bath or bathe in the sea; their soiled linen and any portion of their personal effects or their baggage, open, in the opinion of the sanitary authority, to suspicion, shall be disinfected. In time of cholera, the bilge-water shall be pumped out. The parts of the ship occupied by the sick shall be disinfected. The duration of these operations, including disembarkation and embarkation, must not exceed forty-eight hours.

If no case or suspected case of plague or of cholera be discovered during these operations, the pilgrims shall immediately be re-embarked and the ship shall proceed to Jeddah, where a second medical inspection shall take place on board. If the result be favourable and if the ship's doctor certifies in writing and on oath that there has been no case of plague or of cholera during the passage, the pilgrims shall be landed forthwith. If, however, one or more recognised or suspected cases of plague or of cholera prove to have occurred during the voyage or on arrival, the ship shall be sent back to Kamaran where she shall again be dealt with as infected.

In the case of plague, the provisions of the third paragraph of Article 22 shall apply in the event of there being rats on board.

Art. 128.—*Infected* ships, that is to say, ships with cases of plague or of cholera on board, or that have had cases of plague or of cholera on board within seven days, shall be dealt with as follows:—

Persons suffering from plague or from cholera shall be disembarked and isolated in hospital. The other passengers shall be disembarked and isolated in as small groups as possible, in order that, if plague or cholera break out in one group, the whole party may not be affected.

The soiled linen, clothing and personal effects of the crew and the passengers shall be disinfected, as also shall the ship. The disinfection shall be carried out thoroughly. Provided always that the local sanitary authority may decide that heavy baggage and merchandise need not be unloaded, and that only part of the ship need be disinfected.

The passengers shall remain at the Kamaran station seven or five days, according as to whether plague or cholera is in question. When no cases of plague or of cholera have occurred for several days the period of isolation may be shortened, and may vary according to the date of occurrence of the last case and the decision of the sanitary authority.

The ship shall then proceed to Jeddah, where everyone on board shall undergo a thorough medical examination. If the result be favourable the ship shall be given free pratique. If, however, recognised cases of plague or of cholera have occurred on board during the voyage or on arrival, the ship shall be sent back to Kamaran, where she shall again be dealt with as infected.

In the case of plague, the measures specified in Article 21 regarding rats shall be adopted in the event of there being any of these vermin on board.

1. *The Kamaran Station.*

Art. 129.—At the Kamaran station the following conditions must be fulfilled:—

Complete evacuation of the island by its inhabitants.

For the safety and convenience of shipping in the bay of Kamaran Island, provision of:—

(1) a sufficient number of buoys and beacons;

(2) a main pier or quay for the landing of passengers and baggage;

(3) a separate stage for the embarkation of the pilgrims in each encampment;

(4) a steam tug and sufficient barges for the disembarkation and embarkation of pilgrims.

Art. 130.—The disembarkation of pilgrims from infected ships shall be effected by the ship's own resources. If these be inadequate, the persons and the barges that assist in the disembarkation shall undergo the same measures as the pilgrims and the infected ship.

Art. 131.—The equipment of the sanitary station shall comprise the following:—

(1) A railway-system connecting the landing-places with the administrative buildings, the disinfecting stations, the various staff premises, and the encampments;

(2) administrative buildings and premises for the sanitary and other staff;

(3) buildings for the disinfection and washing of wearing apparel and other articles;

(4) buildings where the pilgrims are to have shower baths or sea baths while their clothes are being disinfected;

(5) separate and completely isolated hospitals for both sexes:—

(*a*) for the observation of suspected persons,

(*b*) for plague patients,

(*c*) for cholera patients,

(*d*) for patients suffering from other contagious diseases,

(*e*) for ordinary patients;

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(6) encampments completely separated from each other, the distance between them to be as great as possible; pilgrims' quarters constructed on the most approved sanitary principles, and not to contain more than 25 persons each;

(7) a well situated cemetery, distant from all dwellings, free from sub-soil water, and drained to the depth of half-a-metre below the level of the graves;

(8) steam disinfectors in sufficient number, and fulfilling all the conditions of safety, efficacy and rapidity; apparatus for destroying rats;

(9) spray-producers, disinfecting chambers and the necessary appliances for chemical disinfection;

(10) water-distilling machines; apparatus for the sterilization of water by heat; ice machines. A system of pipes and covered reservoirs, impervious, and from which water can be taken only by means of taps or pumps, for the distribution of drinking-water;

(11) a bacteriological laboratory with the necessary staff;

(12) provision of portable receptacles for the reception of fœcal matters after disinfection, and a system of disposal of these matters on one of the parts of the island farthest from the encampments, due regard being had to the conditions necessary for the proper working, from a sanitary point of view, of the land used for this purpose;

(13) a system of removal of slop and waste waters from the encampments, which shall prevent their stagnation or use for drinking purposes. The slop and waste waters of the hospitals must be disinfected.

Art. 132.—The sanitary authority shall provide, in each encampment, a store for food and a store for fuel.

The tariff of prices fixed by the competent authority shall be posted up in several places in the encampment, in the languages commonly spoken in the countries inhabited by the pilgrims.

The doctor of the encampment shall be responsible for the daily control of the quality and quantity of the provisions.

Water shall be provided free of charge.

2. *The stations at Abu-Ali, Abu-Said, Jeddah, Vasta, and Yambo.*

Art. 133.—At the sanitary stations of Abu-Ali, Abu-Said, Vasta, as well as those of Jeddah and Yambo the following conditions must be fulfilled:—

(1) the construction of four hospitals at Abu-Ali, two for cases of plague, male and female, two for cases of cholera, male and female;

(2) the construction of a hospital for ordinary cases, at Vasta;

(3) the provision, at Abu-Said and at Vasta, of stone buildings capable of accommodating fifty persons each;

(4) the provision of three disinfecting chambers at Abu-Ali, Abu-Said, and Vasta, with laundries, accessories, and apparatus for destroying rats;

(5) the provision of shower baths at Abu-Said and Vasta;

(6) on each of the islands of Abu-Said and Vasta, provision of distilling machines capable together of yielding 15 tons of water per day;

(7) the disposal of fœcal matters and slop and waste waters on the lines accepted in the case of Kamaran;

(8) the provision of a cemetery on one of the islands;

(9) the provision, at Jeddah and Yambo, of the buildings and plant for sanitary purposes referred to in Article 150, particularly disinfecting chambers, and other means of securing disinfection for the pilgrims returning from the Hedjaz.

Art. 134.—The rules laid down regarding food and water at Kamaran shall apply to the encampments of Abu-Ali, Abu-Said, and Vasta.

B. *Sanitary control of ships from the north going to the Hedjaz with Mohammedan pilgrims.*

Art. 135.—If it be not established that there is plague or cholera at the port of departure or in its neighbourhood, and if no case of plague or of cholera has occurred during the voyage, the ship shall be granted free pratique forthwith.

Art. 136.—If it be established that there is plague or cholera at the port of departure or in its neighbourhood, or if a case of plague or of cholera has occurred during the voyage, the ship shall be dealt with, at El-Tor, in the manner prescribed for ships coming from the south and stopping at Kamaran. The ships shall thereafter be granted free pratique.

SECTION V.—*Measures for pilgrims returning home.*

A. *Homeward bound pilgrim ships, going north.*

Art. 137.—Every ship from a port in the Hedjaz or from any other port on the Arabian coast of the Red Sea, carrying pilgrims or any like collection of persons, and bound for Suez or a Mediterranean port, must proceed to El-Tor, there to undergo the observation and the sanitary measures specified in Articles 141-143.

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Art. 138.—Ships bringing back Mohammedan pilgrims to the Mediterranean shall not pass through the canal save in quarantine.

Art. 139.—Agents of shipping lines and captains of ships are warned that, on completion of their period of observation at El-Tor sanitary station, only Egyptian pilgrims will be permitted to leave the ship definitively, in order to return to their homes. Only pilgrims with a certificate of residence, issued by an Egyptian authority and made out in the form prescribed, shall be recognised as Egyptians or inhabitants of Egypt. Specimens of this certificate shall be deposited with the consular and sanitary authorities at Jeddah and Yambo, where they may be seen by shipping agents and ship captains.

Non-Egyptian pilgrims, such as Turks, Russians, Persians, Tunisians, Algerians, inhabitants of Morocco, &c., may not, after leaving El-Tor, be disembarked at an Egyptian port. Agents of shipping lines and ship captains are therefore warned that the transhipment of non-Egyptian pilgrims at Tor, Suez, Port Said, or Alexandria, is prohibited.

Vessels carrying pilgrims belonging to the nationalities mentioned in the preceding paragraph shall be treated according to the rules for such pilgrims, and shall not be permitted to enter any Egyptian port in the Mediterranean.

Art. 140.—Egyptian pilgrims shall undergo at El-Tor, Suakim, or any other station appointed by the Egyptian Sanitary Board, observation for a period of three days and medical inspection, before being given free pratique.

Art. 141.—If it be established that there is plague or cholera in the Hedjaz or at the port whence the ship has come, or that either of these diseases has occurred in the Hedjaz during the pilgrimage, the ship shall be dealt with, at El-Tor, in the manner prescribed for infected ships at Kamaran.

Persons suffering from plague or cholera shall be landed and isolated in hospital. The other passengers shall be landed and isolated in as small groups as possible in order that, if plague or cholera break out in one group, the whole party may not be affected.

The soiled linen, clothing and personal effects of the crew and the passengers, and such baggage and merchandise as are suspected of being infected, shall be landed for purposes of disinfection. These articles, and also the ship, shall be thoroughly disinfected. Provided always that the local sanitary authority may decide that heavy baggage and merchandise need not be unloaded and that only part of the ship need be disinfected.

The provisions of Articles 21 and 24 regarding rats shall apply in the event of there being any of these vermin on board.

Whether it be plague or cholera that is in question, all the pilgrims shall be kept under observation for seven clear days,

reckoned from the day on which the measures of disinfection were completed. If a case of plague or of cholera occur in a section, the period of seven days for that section shall be reckoned from the day on which the last case occurred.

Art. 142.—In the circumstances provided for by the foregoing Article, Egyptian pilgrims shall, in addition, be kept under observation for a further period of three days.

Art. 143.—If it be not established that there is plague or cholera in the Hedjaz or at the port whence the ship has come, or that either of these diseases has occurred in the Hedjaz during the pilgrimage, the ship shall be dealt with, at El-Tor, in the manner prescribed for healthy ships at Kamaran.

The pilgrims shall be landed; they shall take a shower bath or bathe in the sea; their soiled linen and any portion of their personal effects or their baggage, open, in the opinion of the sanitary authority, to suspicion, shall be disinfected. The duration of these operations, including disembarkation and embarkation, must not exceed 72 hours.

Provided always that a pilgrim-ship, belonging to a country that has given its adhesion to the provisions of this Convention and of previous Conventions, if she has had no case of plague or of cholera during the voyage from Jeddah to Yambo and El-Tor, and if it be established by medical examination, conducted at El-Tor after disembarkation, of every one on board, that she has no such case, may be permitted by the Egyptian Sanitary Board to pass through the Suez Canal in quarantine, even by night, subject to the fulfilment of the four following conditions:—

(1) that, in order to secure medical attendance of persons on board, the ship carries one or more doctors, commissioned by the Government of the country to which she belongs;

(2) that the ship is provided with disinfecting chambers, and it is established that the soiled linen has been disinfected during the voyage;

(3) that it is proved that the number of pilgrims is not in excess of that permitted by the pilgrimage regulations;

(4) that the captain undertakes to sail direct to a port in the country to which the ship belongs.

The medical examination, after disembarkation at El-Tor, must be made with as little delay as possible

The sanitary tax, payable to the quarantine Administration, shall be the same as the pilgrims would have had to pay if they had remained in quarantine for three days.

Art. 144.—In the event of a suspicious case occurring on board during the voyage from El-Tor to Suez, the ship shall be sent back to El-Tor.

Art. 145.—Transhipment of pilgrims at Egyptian ports is strictly prohibited.

Art. 146.—Ships from the Hedjaz, carrying pilgrims bound for the African coast of the Red Sea, shall be permitted to proceed direct to Suakim or such other place as the Alexandria Sanitary Board shall appoint, there to undergo the same quarantine measures as those at El-Tor.

Art. 147.—Ships from the Hedjaz, or from a port on the Arabian coast of the Red Sea, with a clean bill of health, not carrying pilgrims or like collections of persons, and without suspicious incident during the voyage, shall, on favourable medical inspection, be given free pratique at Suez.

Art. 148.—When it is established that there is plague or cholera in the Hedjaz:—

(1) caravans of Egyptian pilgrims must, before proceeding to Egypt, undergo strict quarantine at El-Tor for seven days, whether it be plague or cholera that is in question; they must thereafter be kept under observation at El-Tor for three days, after which they shall not be granted free pratique until after favourable medical inspection and disinfection of effects;

(2) caravans of pilgrims from other countries, returning home by land, shall undergo the same measures as Egyptian caravans, and must be accompanied by sanitary guards to the borders of the desert.

Art. 149.—When plague or cholera has not been reported to have occurred in the Hedjaz, caravans of pilgrims coming from the Hedjaz by way of Akaba or Moila shall, on their arrival at the canal or at Nakhel, undergo medical inspection and disinfection of soiled linen and personal effects.

B.—*Homeward bound pilgrims, going south.*

Art. 150.—The ports of embarkation in the Hedjaz shall be provided with buildings and plant for sanitary purposes sufficient to permit, in the case of pilgrims homeward bound to the south, the taking of the measures, rendered compulsory by the provisions of Articles 46 and 47, on the departure of these pilgrims from ports beyond the Strait of Bab-el-Mandeb. These measures shall be optional; that is to say, they shall not be carried out unless the consular authority of the country to which the pilgrims belong, or the doctor of the ship by which they propose to go, considers them necessary.

CHAPTER III.

PENALTIES.

Art. 151.—Any captain convicted of a breach of his contract for the supply of water, food, or fuel, shall be liable to a fine of 2 pounds Turkish.* This fine shall be paid to the pilgrim who has suffered from the breach of contract on proof that he demanded its fulfilment without effect.

Art. 152.—Any infringement of Article 104 shall be punished by a fine of 30 pounds Turkish.

Art. 153.—Any captain, who commits, or knowingly allows to be committed, any fraud with respect to the list of pilgrims, or of the bill-of-health provided for by Article 110, shall be liable to a fine of 50 pounds Turkish.

Art. 154.—Any ship-captain arriving without a bill-of-health from the port of departure, or without its having been countersigned at the ports of call, or unprovided with the prescribed list, duly kept in accordance with Articles 110, 123, and 124, shall be liable, in each instance, to a fine of 12 pounds Turkish.

Art. 155.—Any captain convicted of having or of having had on board more than 100 pilgrims, without a commissioned doctor, in accordance with the provisions of Article 103, shall be liable to a fine of 300 pounds Turkish.

Art. 156.—Any captain convicted of having or of having had on board more pilgrims than he is permitted, by the provisions of Article 110, to carry, shall be liable to a fine of five pounds Turkish for each pilgrim in excess of the proper number.

The pilgrims in excess of the proper number shall be disembarked at the first station where there is a competent authority, and the captain is bound to provide the pilgrims so disembarked with sufficient money to enable them to reach their destination.

Art. 157.—Any captain convicted of having disembarked pilgrims at a place other than their destination, unless with their consent, or from unavoidable cause, shall be liable to a fine of 20 pounds Turkish for each pilgrim wrongfully disembarked.

Art. 158.—Any other infringement of the provisions relating to pilgrim ships shall be punished by a fine of from 10 to 100 pounds Turkish.

Art. 159.—Any known infringement during the voyage shall be entered in the bill-of-health, and in the list of pilgrims. The competent authority shall prepare a statement of the case and submit it in the proper quarter.

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* A Turkish pound is of the value of 22½ francs.

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Art. 160.—In Turkish ports, infringements of the provisions relating to pilgrim ships shall be tried before, and the fine imposed by, the competent authority, in accordance with the provisions of Articles 173 and 174.

Art. 161.—All agents required to assist in carrying out the provisions of this Convention regarding pilgrim ships shall be liable to punishment, agreeably to the laws of their respective countries, for any failure on their part in carrying out the aforesaid provisions.

PART IV.

Administration and Control.

I.—*The Egyptian Sanitary, Maritime, and Quarantine Board.*

Art. 162.—The provisions of Appendix III. of the Venice Sanitary Convention of January 30th, 1892, regarding the composition, the functions, and the manner of discharge of the functions of the Egyptian Sanitary, Maritime, and Quarantine Board, as provided by the Decrees of His Highness the Khedive under the dates of June 19th, 1893, and December 25th, 1894, and also by the Ministerial Order of June 19th, 1894, are confirmed.

The said Decrees and Order are appended to this Convention.

Art. 163.—The ordinary expenses arising out of the provisions of this Convention, and in particular those due to increase of the staff employed by the Egyptian Sanitary, Maritime, and Quarantine Board, shall be defrayed by an additional yearly contribution by the Egyptian Government of a sum of four thousand pounds Egyptian, which may be paid out of the surplus of the lighthouse dues remaining at the disposal of that Government. Provided always that from this sum shall be deducted the amount produced by an additional quarantine charge of 10 P.T. (piastre tariff) on each pilgrim, to be levied at El-Tor.

In the event of the Egyptian Government finding difficulty in bearing this proportion of the expenses, it would be for the Powers represented on the Sanitary Board to approach the Khedivial Government with a view to securing part of these expenses being borne by the latter.

Art. 164.—It devolves upon the Egyptian Sanitary, Maritime, and Quarantine Board to bring into harmony with the provisions of this Convention the regulations it now applies to plague, cholera, and yellow fever, and also the regulations

regarding arrivals from Arabian ports in the Red Sea during the pilgrimage season. If necessary, it shall revise, to the same end, the general sanitary, maritime, and quarantine police regulations now in force.

To become effective, these regulations must be approved by the several Powers represented on the Board.

II.—*The Constantinople Superior Board of Health.*

Art. 165.—The framing of the measures to be taken with a view to preventing the introduction into the Turkish Empire and the transmission to other countries, of epidemic disease, devolves upon the Constantinople Superior Board of Health.

Art. 166.—The number of Turkish delegates on the Superior Board of Health, having the right to vote, shall be four, namely:—

the President of the Board, or, in his absence, the Acting President of the meeting. They shall have a casting vote only;

the Inspector-General of the sanitary service;

the Assistant-Inspector;

the Delegate acting as intermediary between the Board and the Sublime Porte, known as *Mouhassébedgi*.

Art. 167.—The appointment of the Inspector-General, the Assistant-Inspector, and the Delegate before-mentioned, nominated by the Board, shall be ratified by the Turkish Government.

Art. 168.—The High Contracting Parties recognise the right of Roumania, as a maritime Power, to representation by a delegate on the Board.

Art. 169.—The delegates of the several States must be duly qualified doctors, holding the diploma of a European faculty of medicine, and belonging to the nation they represent, or consular officials of rank not lower than Vice-Consul or of equivalent rank. The delegates must be in no way connected with the local authority or with a shipping company.

These provisions shall not apply to the delegates now in office.

Art. 170.—The decisions of the Superior Board of Health, carried by a majority of its members, shall come into force, without appeal.

The Governments signing this Convention agree that their representatives at Constantinople shall be instructed to inform the Turkish Government of this Convention and to approach that Government with a view to securing its accession thereto.

Art. 171.—The enforcement and the control of the provisions of this Convention regarding the pilgrimages and of measures against the introduction and the spread of plague and of cholera, shall be entrusted, within the scope of the Constantinople Superior Board of Health's jurisdiction, to a Committee selected from among members of that Board exclusively, and composed of representatives of the several Powers adhering to this Convention. The representatives of Turkey on this Committee shall be three in number; one of them shall be the President of the Committee. When the votes are equally divided, the President shall have a casting vote.

Art. 172.—There shall be a staff of qualified doctors, well-trained disinfectors and mechanics, and also sanitary guards selected from persons who have been officers or non-commissioned officers of higher than corporal's rank in the military service, whose duty it shall be to secure, within the jurisdiction of the Constantinople Superior Board of Health, the proper working of the several sanitary establishments enumerated in and prescribed by this Convention.

Art. 173.—The sanitary authority of a Turkish port of call or of arrival, which has convicted anyone of an infringement of the regulations, shall prepare a statement of the case, to which the captain is entitled to add comments in writing. A certified copy of this statement shall be sent, at the port of call or of arrival, to the consular authority of the country under whose flag the ship sails. The amount of the fine imposed shall be deposited with the consular authority or, if there be no consul, with the sanitary authority. The fine shall not be definitively handed over to the Constantinople Superior Board of Health until the consular Commission, described in the Article next following, shall have given judgment as to whether such fine be valid.

Another certified copy of the statement must be forwarded by the convicting sanitary authority to the President of the Constantinople Board of Health, who shall bring the document to the notice of the consular Commission.

The nature of the infringement and the deposit of the fine shall be noted upon the bill-of-health by the sanitary or the consular authority.

Art. 174.—A consular Commission shall be established at Constantinople to decide between contradictory statements made by sanitary agents and incriminated captains. It shall be appointed yearly by the consular authorities. The Sanitary Administration may be represented by a person discharging the duties of public prosecutor. The consul of the country concerned shall always be invited to attend; he shall be entitled to vote.

Art. 175.—The cost of providing, within the jurisdiction of the Constantinople Superior Board of Health, the sanitary posts, both permanent and temporary, prescribed by this Con-

vention, shall be, in so far as construction of buildings is concerned, debited to the Turkish Government. The Constantinople Superior Board of Health is authorised, if necessary and in case of emergency, to advance from the reserve fund the necessary money, which shall, upon demand, be furnished by the "Mixed Commission entrusted with the revision of sanitary charges." In this event, the Board must see to the construction of these establishments.

The Constantinople Superior Board of Health must organise, without delay, the sanitary stations of Hanikin and Kizil-Dizié, near Bayazid, on the Turko-Persian and Turko-Russian frontiers, out of the moneys now placed at its disposal.

The other expenses arising, within the jurisdiction of the said Board, from the measures prescribed by this Convention, shall be mutually borne by the Turkish Government and the Constantinople Superior Board of Health, as agreed upon by the Government and the Powers represented on the Board.

III.—*The Tangier International Board of Health.*

Art. 176.—In the interests of the public health, the High Contracting Parties agree that their representatives in Morocco shall again direct the attention of the Tangier International Board of Health to the necessity of carrying out the provisions of the sanitary Conventions.

IV.—*Miscellaneous provisions.*

Art. 177.—Each Government shall decide as to the means it shall employ to secure disinfection and the destruction of rats.*

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* The following methods of disinfection are given by way of guide:—

Wearing-apparel, old rags, infected dressings, papers and other articles of no value should be burnt.

Personal effects, bedding, mattresses infected with plague can be efficiently disinfected either by means of a high-pressure steam disinfecting chamber or a current-steam disinfecting chamber at a temperature of 100° Centigrade, or by exposure to formol vapours.

Articles, such as coverlets and bed-linen, that can be steeped in antiseptic solutions without damage, can be disinfected by 1 per 1,000 solutions of perchloride of mercury, 3 per 100 solutions of carbolic acid, 3 per 100 solutions of lysol or commercial cresyl, 1 per 100 solutions of formol (one part of the commercial solution of formaldehyde at 40 per 100), or 1 per 100 solutions of the alkaline hypochlorites (sodium or potassium), that is to say, 1 part of the ordinary solution of commercial hypochlorite. The period of contact must obviously be long enough to allow dried germs to be well penetrated by the antiseptic solution: four to six hours will suffice.

To secure destruction of rats, three processes are now made use of:—

(1) Sulphurous acid mixed with a small quantity of sulphuric anhydride, driven under pressure into holds and mixed with the air. This destroys rats and insects and will, it is stated, destroy the plague-bacillus also if the proportion of sulphuro-sulphuric anhydride be sufficiently great.

(2) An incombustible mixture of carbon monoxide and carbon dioxide, passed into holds.

(3) Carbonic acid so employed as to constitute 30 per cent. of the air in the ship.

The last two methods kill rodents but it is not claimed that they destroy insects or the plague-bacillus.

The Technical Commission of the Paris (1903) Sanitary Conference specified the three following processes—a mixture of sulphuro-sulphuric anhydrides, a mixture of carbonic oxide and carbonic acid, and carbonic acid,—as being among those to which Governments might resort, and expressed the opinion that the sanitary authority should, in every instance where it did not itself do the work, superintend its performance and make sure that the rats had been killed.

APP. A, No. 1.
Translation of the International Sanitary Convention, 1903; by Dr. Theodore Thomson.

Art. 178.—The sums realised by sanitary charges and fines may not, in any instance whatever, be used for any purposes other than those under the control of the Boards of Health.

Art. 179.—The High Contracting Parties undertake that their Public Health Departments shall frame a set of instructions intended to enable ship captains, particularly when there is no doctor on board, to carry out the provisions of this Convention regarding plague and cholera, and also to carry out the regulations regarding yellow fever.

V.—*The Persian Gulf.*

Art. 180.—The cost of construction and upkeep of the sanitary station to be provided, in accordance with Article 81 of this Convention, on the Island of Ormuz, shall be debited to the Constantinople Superior Board of Health. The said Board's Mixed Commission of revision shall meet at the earliest date possible in order to furnish, on the Board's request, the necessary moneys to be derived from the available reserve funds.

VI.—*International Health Office.*

Art. 181.—The Conference having taken note of the resolutions, hereto appended, passed by its Commission of Ways and Means regarding the creation of an International Health Office in Paris, the French Government shall, at such time as it may think fit, submit, by diplomatic channels, proposals on this subject to the States represented at the Conference.

PART V.

Yellow Fever.

Art. 182.—The countries concerned are recommended to modify their sanitary regulations in such fashion as to bring them into harmony with the present scientific data as to the manner in which yellow fever is transmitted and, in particular, as to the part played by mosquitoes in carrying the germs of the disease.

PART VI.

Adhesion and Ratification.

Art. 183.—The Governments that have not signed this Convention are allowed to become parties thereto at their request. Such adhesion shall be notified, by diplomatic channels, to the Government of the French Republic, and by that Government to the other Governments that have signed the Convention.

Art. 184.—This Convention shall be ratified, and the ratifications thereof shall be deposited at Paris as soon as may be practicable.

It shall be put in force as soon as it shall have been made public in such manner as is in accordance with the laws of the States that sign it. As regards the relations between the Powers that ratify or become parties to it, it shall replace the International Sanitary Conventions signed on January 30th, 1892, April 15th, 1893, April 3rd, 1894, and March 19th, 1897.

The previous Conventions, above cited, shall continue in force in the case of Powers which, having signed or become parties to them, do not ratify or become parties to this Convention.

APPENDIX I.

(*See Art.* 78.)

REGULATIONS

REGARDING THE CONVEYANCE OF PASSENGERS AND MAILS FROM INFECTED COUNTRIES THROUGH EGYPT BY QUARANTINE TRAIN.

Art. 1.—The Egyptian Railway Executive that wishes to run a quarantine train in connection with ships arriving from infected ports, must give notice thereof to the local quarantine authority not less than two hours before the time of departure of such train.

Art. 2.—The passengers shall land at a place appointed by the quarantine authority with the consent of the Railway Executive and the Egyptian Government, and shall proceed, without any communication, direct from the ship to the train, under the supervision of a transit-officer and of two or more sanitary guards.

Art. 3.—The passengers' personal belongings, baggage, &c., shall be conveyed in quarantine, by the means at the disposal of the ship.

Art. 4.—In so far as quarantine measures are concerned, the railway staff shall obey the orders of the transit-officer.

Art. 5.—The carriages employed in this service shall be corridor carriages. In each carriage there shall be a sanitary guard, whose duty it shall be to keep watch over the passengers. The railway staff shall not hold any communication with the passengers.

A doctor on the quarantine staff shall go with the train.

Art. 6.—The passengers' heavy baggage shall be put in a special van, which the transit-officer shall seal before the train starts. Upon arrival, the seals shall be removed by the transit-officer.

Transference of passengers to another train or taking passengers during the journey is prohibited.

Art. 7.—The closets shall be furnished with pails, containing a certain amount of antiseptic, for the reception of the passengers' dejecta.

Art. 8.—No one, except the staff absolutely necessary, shall be allowed on railway-platforms at which the train may have to stop.

Art. 9.—Every train may have a restaurant-car. The remnants of meals shall be destroyed. The staff of the restaurant-car and such other railway-servants as have come in contact, from any cause, with passengers, shall undergo the same measures as the pilots and electricians at Port Said or Suez, or such measures as the Board may consider necessary.

Art. 10.—Passengers are absolutely prohibited from throwing anything whatever out of the windows, doors, &c.

Art. 11.—In every train a hospital-compartment shall be kept empty so as to secure isolation of the sick therein, should such contingency arise. This compartment shall be fitted up in accordance with the directions of the quarantine Board.

If plague or cholera appear among the passengers, the sick person shall immediately be isolated in the special compartment, and shall, on the arrival of the train, be removed forthwith to the quarantine lazaret. The other passengers shall proceed on their journey in quarantine.

Art. 12.—If a case of plague or of cholera occur during the journey, the train will be disinfected by the quarantine authority.

In all instances the vans carrying baggage and mails shall be disinfected immediately after the arrival of the train.

Art. 13.—The transference of passengers, baggage, &c., from train to ship shall be effected in the same way as on arrival. The ship that takes the passengers shall immediately be put in quarantine, and any incident that may have occurred during the journey shall be noted on the bill-of-health, with specific mention of any persons that may have been in contact with the sick.

Art. 14.—The expenses incurred by the quarantine administrative body shall be debited to whoever requisitioned the quarantine train.

Art. 15.—The President of the Board, or his substitute, shall have the right to exercise supervision over the train during the whole of its journey. The President may, moreover, entrust the duty of such supervision to a high official (above and beyond the transit-officer and the sanitary guards). This official shall have access to the train on his showing an order signed by the President.

APPENDIX II.

(*See Art.* 162.)

[*This Appendix, consisting of the Khedivial Decrees of* 19*th June*, 1893, *and* 25*th December*, 1894, *and of the Ministerial Order of* 19*th June*, 1893, *is not here reproduced.*]

APPENDIX III.

(*See Art.* 181.)

RESOLUTIONS

PASSED BY THE COMMISSION OF WAYS AND MEANS OF THE SANITARY CONFERENCE OF PARIS REGARDING AN INTERNATIONAL HEALTH OFFICE.

I.—An International Health Office shall be established on the lines followed in the institution and conduct of the International Office of Weights and Measures. It shall have its seat in Paris.

II.—The International Office shall fulfil the function of collecting information as to the progress of infectious diseases. To this end it shall receive information given to it by the chief Health Authorities of the States that are parties to it.

III.—The Office shall periodically set out the results of these labours in official reports, which shall be communicated to the contracting Governments. These reports must be made public.

IV.—The Office shall be supported by contributions from the contracting Governments.

V.—The Government, in whose country the International Office is to be established, shall be charged with the submission, within three months of the signing of the proceedings of the Conference, for the approval of the contracting States, of Regulations for the institution and conduct of that Office.

No. 2.

pp. A, No. 2. est Indian nitary nvention, 4.

THE WEST INDIAN INTER-COLONIAL SANITARY CONVENTION, 1904.

[Adopted by Legislation in Barbados, Jamaica, Trinidad, British Guiana, Grenada, St. Lucia, St. Vincent, and the Leeward Islands.]

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1. The Quarantine Regulations annexed to the present Convention are adopted. The existing quarantine enactments and regulations in the Colonies adhering or acceding to this Convention shall be repealed by such Colonies so far as such enactments and regulations are repugnant to or inconsistent with this Convention and the Quarantine Regulations annexed thereto.

2. Every Colony shall as soon as possible notify by telegram to the other Colonies the first appearance within such Colony of recognised cases of infectious or contagious disease as defined in the Quarantine Regulations annexed to the present Convention. Such notification shall be accompanied or promptly followed by detailed information on the following points:—

(1.) The locality in which the disease has made its appearance.

(2.) The date of its appearance, its source, and the type which it presents.

(3.) The known number of cases and deaths.

(4.) In the case of plague, whether that disease or any unusual mortality has been observed among rats or mice in the locality.

(5.) The measures adopted immediately upon the first appearance of the disease.

3. The notification and the particulars specified in Article 2 shall be followed by information systematically furnished in such fashion as to ensure that the other Colonies be kept acquainted with the progress of the disease. This information shall be sent at least once a week, if practicable, and shall be as complete as possible. It shall, in particular, indicate the measures adopted with a view to checking the spread of the disease and shall specify what steps are being taken :—

(1.) in the way of medical and sanitary inspection, isolation, and disinfection :

(2.) in the case of plague, to secure destruction of rats :

(3.) in the case of yellow fever to secure destruction of mosquitoes on and near infected premises :

(4.) in the case of small-pox to secure vaccination and re-vaccination :

(5.) to prevent transmission of the disease to the other Colonies.

4. Every Colony shall immediately inform any Colony within which there is an infected place as defined in the Quarantine Regulations annexed to the present Convention as to the measures which it is proposed to take against arrivals from that Colony or place ; and shall, in like manner, inform such Colony as to the modification or withdrawal of these measures.

5. Colonies which have not taken part in the present Conference or which have not given their adhesion to this Convention may accede to it at their request.

6. The present Convention shall remain in force for five years from the date of the coming into operation of the confirmatory legislative enactments passed by the British West Indian Colonies which give their adhesion to this Convention. During that period no alteration or modification of this Convention or of the Quarantine Regulations annexed thereto shall be made without the consent of all the Colonies adhering or acceding thereto. It shall be renewed quinquennially, without formal extension, unless one of the adhering or acceding Colonies within six months before the expiration of the above-mentioned quinquennial period, has signified its intention of being no longer bound by the Convention or its desire that the Convention should be altered or modified.

QUARANTINE REGULATIONS.

1. In these regulations :—

"Health Officer" means any duly qualified medical practitioner appointed or employed to act in the execution of these Regulations, or authorised to act for or assist him.

"Ship" includes vessel, boat, or other floating craft.

"Master" means the master, officer or other person for the time being in charge of any ship.

"Infectious or contagious disease" means cholera, plague, yellow fever, and small-pox, and shall not include typhus fever, enteric fever, cerebro-spinal fever, scarlet fever, diphtheria, measles, whooping cough, chicken-pox, or dengue.

"Place" means any clearly defined portion of territory such as an island, a port, a district, a parish, a town, or a village.

"Infected place" means any place where any infectious or contagious disease exists : Provided that a place shall not be regarded as an infected place because of the existence thereat of imported cases of such disease or because of the occurrence of a single non-imported case.

APP. A, No. 2.

West Indian Sanitary Convention, 1904.

"Infected ship" means a ship on board of which a case or cases of infectious or contagious disease are present or have occurred within a period of seven days previous to the date of the arrival of the ship, except in the case of small-pox, when such period shall be twelve days.

"Suspected ship" means a ship on board of which a case or cases of infectious or contagious disease have occurred during the voyage or during the stay of such ship in the port of departure, but on board of which no fresh case has occurred within a period of seven days previous to the date of arrival of the ship, except in the case of small-pox when such period shall be twelve days.

"Healthy ship" means a ship which, although having come from an infected place, has had on board no death from, nor any case of, infectious or contagious disease, either before leaving the port of departure, or during the voyage, or on arrival.

"Observation" means isolation of passengers, either in a proper station provided for that purpose or on board ship, prior to their obtaining free pratique.

"Surveillance" means that passengers are not isolated. They receive free pratique at once and are allowed to proceed to their place of destination (the proper authority of which must be informed of their arrival), there to undergo medical supervision.

2. With a view to restricting the range of application of these regulations the measures therein specified shall be applied in respect, not of a whole Country or Colony, but only of the infected place, but this limitation shall apply only if the Health Officer is satisfied that the Country or Colony in which the infected place is situate takes the measures necessary to prevent export of the rags, clothing, and bedding referred to in Article 14 from that place unless they shall have been previously disinfected, and also takes measures necessary to check the spread of the disease.

3. A place shall cease to be regarded as infected if the Health Officer is satisfied that :—

(*a*) There has been no new case of plague or cholera within five days, of yellow fever within six days, or of small-pox within twelve days of the isolation, or of the death or recovery of the last case :

(*b*) Infected things have been disinfected or destroyed, and that in the case of plague, measures have been taken with a view to the destruction of rats in the infected locality, and, in the case of yellow fever, of mosquitoes on and near the infected premises.

4. Every infected or suspected ship and every ship arriving from an infected place shall be inspected as soon as possible after arrival by the Health Officer The Health Officer may

board any ship arriving in the waters of the Colony, and inspect every person in the ship. He may, if he think proper, call for inspection of the ship's books and papers, and he shall use every lawful means which may seem to him expedient for ascertaining the state of health of the persons on board and the sanitary condition of the ship.

The Master of any ship, or any other person, shall answer truly and, if required, in writing and on oath, all such questions put to him by and give all such information to the Health Officer as may be necessary for any purpose of these Regulations.

5. *Infected ships* shall be dealt with as follows :—

(*a*) The sick shall as soon as possible be removed from the ship and isolated :

(*b*) The other persons on board shall be permitted to land and be kept under observation or subjected to surveillance. When observation is resorted to, the period shall not exceed five days in the case of plague and cholera, six days in the case of yellow fever, and twelve days in the case of small-pox. When surveillance is resorted to, the period shall be the same as that of observation save in the case of plague when it may be extended to a period not to exceed ten days. In applying these measures the date of the last case and the condition of the ship should be taken into account :

(*c*) Clothing and articles belonging to the passengers or crew which, in the opinion of the Health Officer, are infected, shall be disinfected or destroyed :

(*d*) Those parts of the ship that have been occupied by the sick shall be disinfected, and also such other parts of the ship as the Health Officer may regard as infected :

(*e*) In the case of plague, measures shall be taken, either before or after discharge of cargo to secure the destruction of rats on board. This operation shall be commenced as soon and carried out with as little delay as possible, and its duration shall not in any case exceed forty-eight hours :

(*f*) In the case of yellow fever measures shall be taken to secure the destruction of mosquitoes and their larvæ on board :

(*g*) In the case of cholera the bilge water, after preliminary disinfection, shall be pumped out, and the drinking water on board may be replaced by a fresh supply of wholesome water.

When such measures as the Health Officer may have deemed necessary, in accordance with the provisions of this article, have

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been carried out, such ship shall immediately thereupon be admitted to free pratique.

6. *Suspected ships* shall be dealt with as follows :—

(*a*) The passengers and crew may be subjected to surveillance during a period which shall not exceed five days in the case of plague and cholera, six days in the case of yellow fever, and twelve days in the case of small-pox. The period of surveillance shall date from the arrival of the ship :

(*b*) Paragraphs (*c*), (*d*), and (*g*) of Article 5 shall also apply to suspected ships ; and the measures specified in paragraphs (*e*) and (*f*) should also be applied.

When such measures as the Health Officer may have deemed necessary, in accordance with the provisions of this article, have been carried out, such ship shall immediately thereupon be admitted to free pratique.

7. *Healthy ships* shall be admitted to free pratique immediately on arrival, irrespective of the nature of their bill of health. They may, however, at the discretion of the Health Officer, be subjected to the measures specified in paragraphs (*c*), (*e*), (*f*) and (*g*) of Article 5 ; and the passengers and crew may be subjected to surveillance which shall not exceed five days in the case of plague and cholera, six days in the case of yellow fever, and 12 days in the case of small-pox. The period of surveillance shall date from the departure of the ship from the infected place. It is to be understood that the application of the measures specified in paragraph (*c*) of Article 5 can be justified only by special reasons, and that those of paragraph (*e*) of Article 5 are not to be applied as a general rule. In those cases where the provisions of paragraph (*e*) of Article 5 are applied, the operation shall not in any case exceed 24 hours, and shall not interfere with the free circulation of passengers and crew between ship and shore.

8. If in a healthy ship the rats on board are found to be suffering from plague, the Health Officer shall visit the ship and measures shall be taken as in paragraphs (*c*) and (*e*) of Article 5 ; the parts of the ship that the Health Officer may regard as infected shall be disinfected ; and the passengers and crew may be subjected to surveillance which shall not exceed a period of five days after arrival, unless in exceptional cases when such period may be extended to 10 days. If unusual mortality has been observed among the rats on a healthy ship, the Health Officer shall visit the ship and a bacteriological examination of the rats shall, when practicable, be made as quickly as possible. If it is thought necessary to resort to measures of rat-destruction these shall be carried out as specified in paragraph (*e*) of Article 5. Until all suspicion of plague is removed, the passengers and crew may be subjected to surveillance during the time specified in this Article in respect of ships on board of which rats are found to be suffering from plague.

9. Whenever the master, the shipowner, or the shipowner's agent shall so demand, the Health Officer of the port shall furnish him with a certificate that measures for the destruction of rats have been applied, and specifying the reasons why they had been applied.

ART. 5. No. West Indian Sanitary Convention, 1914.

Passengers arriving by an infected vessel shall be entitled to a certificate from the Health Officer indicating the date of their arrival and the measures to which they and their baggage have been subjected.

10. Ships from an infected place which have been disinfected shall not again be subjected to sanitary measures on their arrival in another port, if in the opinion of the Health Officer of such port the measures applied were effective, unless a fresh case of infectious or contagious disease has occurred on board since disinfection or unless they have again called at an infected place. A ship shall not be regarded as having called at a place if it has merely disembarked passengers and their baggage or mails, without having been in communication with the shore.

11. Where a ship has passengers on board who are in a filthy or otherwise unwholesome condition, or is overcrowded with passengers, emigrants, or otherwise, the Health Officer may, if in his opinion it is desirable, with a view of preventing the introduction of any infectious or contagious disease and on the certificate to that effect, subject persons on board to observation or to surveillance for such period as he may direct not exceeding the period specified for the particular disease in question in paragraph 5 of Article 5.

12. Where measures of observation or surveillance are prescribed the Health Officer may exempt from their application any person who is, in his opinion, immune to the infectious or contagious disease on account of which these measures are applied.

13. Where these Regulations provide that a person may be permitted to proceed to his place of destination subject to surveillance, the Health Officer, before granting such permission, must be satisfied that it is reasonably probable that the person to whom it is granted will duly comply with the conditions of surveillance, and permission, if granted, shall be upon the following conditions :—

(*a*) He must satisfy the Health Officer as to the destination intended place of destination and the place of residence thereat :

(*b*) He must agree to present himself and submit himself for medical supervision during the prescribed period, and he may be required by the Health Officer to deposit a sum not exceeding two pounds, which may be forfeited if he fails to so present himself :

(*c*) The place must, in the opinion of the Health Officer, be conveniently situated for the medical supervision.

APP. A, No. 2.
West Indian Sanitary Convention, 1904.

If the Health Officer is not satisfied as herein required, or if the person fails to comply with paragraphs (*a*) and (*b*) hereof, the Health Officer may detain him under observation, or direct him to proceed to a specified place and there remain under medical supervision during the prescribed period. In the latter case the provisions of paragraph (*b*) hereof may, at the discretion of the Health Officer, be applied to such person. Provided always that in the case of small-pox a person may be required to produce to the Health Officer satisfactory evidence of having been successfully vaccinated, or re-vaccinated within the ten years immediately preceding, or of his being otherwise immune to the disease, and that such persons may in the absence of such evidence be detained under observation for the prescribed period.

In the case of a Healthy Ship the measure authorized by the foregoing proviso must not be applied to passengers who have not embarked or gone ashore at the infected place, and it should not be applied to those passengers who embarked or went ashore at the infected place, if the circumstances of their stay there afford reasonable evidence of non-infection.

14. Merchandise shall be disinfected only when, in the opinion of the Health Officer, it is infected: Provided always that, in the case of plague, cholera, and small-pox, clothing and bedding which have been used, and rags, may, when imported from an infected place as merchandise, be subjected to disinfection even in the absence of evidence that they are infected, or their introduction into the Colony may be prohibited, except that in the case of cholera, rags compressed in bales, if in the opinion of the Health Officer they are free from infection, shall not be subjected to the provisions of this article. Provided further that in the case of yellow fever, merchandise shall under no circumstances be liable to disinfection or prohibition.

The measures specified in this article are the only measures that can be applied in respect of merchandise. The entry of live stock into any Colony shall not be prohibited because of the existence of an infectious or contagious disease in the place from whence they have come or on board the ship in which they are conveyed.

15. When merchandise has been subjected to disinfection in pursuance of provisions in these Regulations, the owner or his agent shall be entitled to a certificate from the Health Officer indicating the measures that have been taken.

16. Nothing in these Regulations shall render liable to detention, disinfection, or destruction any article forming part of any mail (other than a parcel mail) conveyed under the authority of the postal administration of any Government, or shall prejudicially affect the delivery in due course of any such mail (other than a parcel mail) to the Post Office.

The only measures which parcel mails may be subjected to shall be disinfection or destruction of articles which are in the opinion of the Health Officer infected.

17. When any port within the Colony is an infected place, measures shall be taken to prevent the embarkation at such port

of any person showing symptoms of infectious or contagious disease. To this end, every person taking passage on a ship leaving such port shall be examined by the Health Officer immediately before departure of the vessel. Such examination shall, as far as practicable, be made by day and on shore. Measures shall be taken to prevent the exportation of merchandise or articles which the Health Officer may consider infected unless such merchandise or articles shall, in the first instance, have been disinfected on shore under his supervision. Measures shall be taken to prevent rats in the case of plague, and mosquitoes in the case of yellow fever from gaining access to ships. When access of mosquitoes to the ship cannot be prevented, measures should be taken immediately before departure of the vessel, to secure destruction of the mosquitoes on board. In the case of cholera, care shall be exercised that drinking water taken on board is wholesome. The Health Officer shall give to the master of the ship a certificate stating in detail the measures taken.

18. When, in the case of a healthy ship from a port which is an infected place, the Health Officer at the port of arrival is satisfied that the measures specified in Article 17 have been efficiently carried out, such ship shall be exempted from the measures specified in Article 7. Provided always that if the period specified in that article, and dating from departure of the ship from the infected place, shall not have been completed, the passengers and crew may be subjected to surveillance of such duration as is necessary to complete the period.

19. No measures shall be taken against any ship merely because it has come from or called at any place where typhus fever, enteric fever, cerebro-spinal fever, scarlet fever, diphtheria, measles, whooping cough, chicken-pox or dengue exists. If a case or cases of any of these diseases have occurred on board a ship before leaving the port of departure, during the voyage, or on arrival, the measures that may be applied shall be limited to isolation of the sick, disinfection of infected clothing, bedding and effects, and of the compartment of the vessel occupied by the sick, and surveillance of those who have been in contact with the sick person or persons.

APPENDIX.

Report of the British West Indian Conference on Quarantine.

To the Right Honourable Alfred Lyttelton, M.P., His Majesty's Principal Secretary of State for the Colonies.

Sir,—We, the Delegates appointed by our respective Governments to represent them at a Conference of the several British West Indian Colonies held in Barbados to consider the question of quarantine in these Colonies and the substitution for the existing systems of uniform precautionary measures of a different nature, have the honour to report as follows :—

2. The Conference assembled at Bridgetown, Barbados, on Monday, the 25th of April, 1904, and was opened by the Governor, Sir Frederic Mitchell Hodgson, K.C.M.G., and continued its sittings on each day in that week and on five days in the following week, *April 25th to May 6th inclusive*, under the presidency of Mr. William Henry Stoker, K.C., Attorney-General of Barbados; Dr. Theodore Thomson, one of the Inspectors of the Local Government Board of England and Wales, was in attendance throughout the proceedings. The duties of Secretary were performed by Mr. W. H. Allder, of the Colonial Secretary's Office, Barbados.

3. The following initial Resolution was passed :—

(1.) "That in view of the development of medical science it is possible, and in the interests of trade and communication necessary, to discard some of the restrictions which have in the past been thought essential in the British West Indian Colonies for guarding against the introduction of infectious and contagious diseases, and to substitute precautionary measures of a different nature.

(2.) "That such measures as may be adopted in lieu of the existing systems should be uniform; and

(3.) "That such measures may most conveniently be embodied in a Convention to be adopted and adhered to for a term of years by the several Colonial Governments represented at this Conference."

4. In furtherance of this Resolution we recommend that the Convention contained in the Appendix to this Report, with the Regulations annexed to the Convention, be entered into, adopted, and adhered to by the several Governments represented at this Conference.

5. It is in our opinion desirable, with the view of enlarging the sphere of the Convention, that steps be taken to invite neighbouring British Colonies and adjacent Foreign Countries and Colonies to accede thereto.

6. The recommendatory Resolutions appended to this Report were passed by the Conference. With a view to limiting as far as possible the points of agreement between the Colonies, we did not consider it desirable to include their subject matter in the Convention, but we consider these supplementary recommendations of importance, more especially that relating to the proposed creation of a Central Quarantine Authority.

7. A Committee of three medical Delegates in conjunction with Dr. Thomson was appointed to report on the methods of disinfection, &c., and the Conference has decided to append to the Report certain transcripts for the guidance of the Health Officers. These transcripts are from the International Conventions of 1897 and 1903, and from the Quarantine Laws and Regulations of the United States, 1903, as well as from a paper by Dr. Guiteras in the Public Health Reports of the United States of July, 1903.

8. On behalf of the Colonies we represent, we desire to place on record our sense of the further debt of gratitude owed by the West Indies to your predecessor in Office, Mr. Joseph Chamberlain, for his action in convening this Conference, the results of which to trade and communication in this part of the world cannot fail to be beneficial; and which will, we trust, be substantial evidence that it is possible for the West Indian Colonies to act in unison for definite public objects through the medium of representatives delegated by the several Governments.

9. Our appreciation of Mr. Chamberlain's action in this matter is enhanced by the wisdom of his decision to afford our Conference the advice and assistance of an Expert in the subject with which we have been entrusted, and we cannot speak too highly of the valuable aid which we have received from Dr. Theodore Thomson, who was selected for that purpose. If, as we hope, our labours result in success, such success will in great measure be due to the important part taken in our deliberations by Dr. Thomson, whose knowledge of the details of the subjects discussed was freely placed at our disposal.

10. The Minutes of our proceedings are appended.

We have, &c.,

W. H. STOKER, JOHN HUTSON. } Delegates for Barbados.
J. E. GODFREY, G. H. RICHTER. } " " British Guiana.
J. F. DONOVAN. Delegate for Jamaica.
W. H. WHYHAM, H. A. ALFORD NICHOLLS, W. H. FRETZ. } Delegates for Leeward Islands.
JAS. A. DEWOLF, R. H. MCCARTHY. } Delegates for Trinidad.
EDWARD DRAYTON, C. W. BRANCH, WM. LOW. } Delegates for Windward Islands.

W. H. STOKER,
President of the Conference.
W. H. ALLDER,
Secretary to the Conference.

House of Assembly Room,
Barbados, 6th May, 1904.

RECOMMENDATORY RESOLUTIONS.

1. *Resolved*:—"That to ensure the due observance of the Convention by the several Colonies concerned and to secure that disputed questions arising out of the Regulations be authoritatively settled, and also for the purpose of deciding whether any disease known to exist in any Colony is one of the infectious or contagious diseases defined by the Regulations, it is, in the opinion of this Conference, necessary to create a Central Quarantine Authority for the West Indian Colonies, to consist of one representative appointed by each of the Governments adhering or acceding to the Convention, and a President to be appointed by the Secretary of State for the Colonies, such authority to be constituted as soon as possible after the ratification of the Convention, and to meet when summoned by the President upon the requisition of any two of such Governments, and at such place as he may direct."

2. *Resolved*:—"That in the opinion of this Conference the provision by each of the Colonies adhering or acceding to the Convention of an Observation Station, and an Isolation Hospital, adequate in size and equipment to the volume of the passenger traffic of each Colony is indispensable to the successful working of a proper precautionary system against the introduction of infectious or contagious diseases."

3. *Resolved*:—"That in the opinion of this Conference it is essential to the success of the system of surveillance of passengers, provided for by the Regulations, that no fees should be payable by such passengers for medical supervision."

4. *Resolved*:—"That in the opinion of this Conference, so as to facilitate the efficient working of these Regulations, it is desirable that a law to make compulsory the notification of infectious and contagious disease as defined in these Regulations be adopted in those Colonies, where such a law does not obtain."

West Indian Quarantine Conference, 1904.

Report on Methods of Disinfection.

We, the Committee appointed to report on the methods of Disinfection, beg to submit the following :—

We recommend that there should be an appendix to the Regulations headed :

"Information concerning methods of Disinfection for the guidance of Health Officers."

This information should consist of transcripts from the International Sanitary Conventions of 1897 and 1903, and from the Quarantine Laws and Regulations of the United States, 1903, and from a paper by Dr. Guiteras on the Public Health Reports of the United States, July 31st, 1903.

The extracts we recommend are attached to this report.

We desire to acknowledge the valuable assistance given us by Dr. Theodore Thomson in dealing with this matter.

J. A. DeWolf,
Chairman.

H. A. Alford Nicholls.
John Hutson.

Barbados, May 1, 1904.

Information Concerning Methods of Disinfection, &c., for the Guidance of Health Officers.

Extracts from the International Sanitary Convention of 1897.

Instructions recommended regarding the method of disinfection.

1. Old clothes, old rags, infected dressings, papers, and other articles of no value should be destroyed by fire.

2. Under-clothing, bedding, clothes, mattresses, carpets, &c., which are contaminated or suspected should be disinfected in disinfecting chambers at *normal pressure, or at a pressure of from one-and-a-half to two atmospheres, with or without circulation of saturated steam.*

Before a disinfecting chamber can be regarded as efficient for the purposes of disinfection, it must be subjected to tests, with the aid of a *signal thermometer*, showing the moment when the temperature in the middle of a mattress rises to at least 100° (Centigrade).

To ensure that the disinfection is effective, this temperature must be maintained for from 10 to 15 minutes.

3. Disinfecting solutions—

(*a*) Solution of corrosive sublimate, of 1 part in 1,000, *with the addition of* 10 *parts of chloride of sodium.*

The solution should be coloured with *aniline blue or indigo.* It should not be placed in metal vessels.

(*b*) A 5 per cent. solution of pure crystallized carbolic acid, *or* 5 *per cent. of crude commercial carbolic acid in a warm solution of soft soap.*

(*c*) Fresh slaked lime.*

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* To get very strong slaked lime, take lime of good quality, slake it, by moistening it gradually, with half its weight of water. When the operation is completed, put the powder in a carefully corked receptacle, and place it in a dry spot. As each kilogramme of lime absorbs 500 grammes of water in order to become slack, it acquires a volume of 2 litres 200, and it is sufficient to dilute it with double its volume of water, say 4 kilogrammes 400 grammes to obtain a whitewash which will be of about 20 per cent. strength of lime.

4. Special instructions to be observed in the employment of disinfecting solutions.

The linen, clothing, and articles soiled by the excreta of patients should be soaked in the solution of corrosive sublimate. The solution of pure carbolic acid. and the solution of soap and carbolic acid. are perfectly suitable for the same purpose. The articles should remain in the solution for at least six hours.

Articles which cannot be subjected to the temperature of the disinfecting chamber (100° Centigrade) without injury. such as leather goods, wooden articles stuck together with glue, felt, velvet, silk, &c., should be washed with the solution of corrosive sublimate; coins can be disinfected with the solution of soap and carbolic acid.

Persons in attendance on the sick should wash their hands and faces with the solution of corrosive sublimate, or with one of the carbolic solutions.

The carbolic solutions will be useful more particularly for disinfecting articles, such as metals, instruments. &c., which can neither be subjected to a temperature of 100° Centigrade, nor placed in contact with corrosive sublimate without damage.

Slaked lime is particularly recommended for disinfecting excreta and vomited matters. Expectorated and purulent matters should be burnt.

5. Disinfection of ships with plague patients on board.

The cabin or cabins, and all parts of the ship occupied by the sick or suspected should be cleared out and all articles in them should be treated as described above.

The walls should be disinfected with the solution of corrosive sublimate with an addition of 10 per cent. of alcohol. The spraying should commence from the top horizontally, and be continued downwards. so that the whole surface of the wall becomes covered with a coating of minute drops.

The flooring should be washed with the same solution.

Two hours after, the walls and flooring should be scrubbed and washed down with plenty of water.

6. Disinfection of the hold of an infected ship.

To disinfect the hold, sulphate of iron, in quantity sufficient to neutralise the sulphurated hydrogen, should first be thrown in, the bilge-water should be pumped out, and the hold washed with sea-water. Solution of corrosive sublimate should then be thrown in.

EXTRACTS from the International Sanitary Convention of 1903.

The following methods of disinfection are given by way of information :—

Old clothes, old rags, infected dressings, papers, and other articles of no value, should be burned.

Clothing, bedding, and mattresses infected with plague can be effectively disinfected either by passing them through a steam disinfector, whether the steam be current or under pressure, or by subjecting them to formal vapour.

Articles such as sheets and blankets, that can without damage be soaked in antiseptic solution, can be disinfected by solutions of corrosive sublimate of the strength of 1 per 1,000, of carbolic acid of the strength of 3 per cent., of lysol and commercial cresyl of the strength of 3 per cent., of formal of the strength (one part of the commercial solution of formaldehyde of 40 per cent.) or of the alkaline hypochlorites (sodium, potassium) of the strength of 1 per cent. (that is to say, one part of the ordinary solution of commercial hypochlorite). The period of contact must be long enough to allow complete access to germs in the dried state : four to six hours are sufficient.

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For the destruction of rats, three methods are in use :—

(1.) Sulphurous acid mixed with a small quantity of sulphuric anhydride, driven under pressure into holds and mixed with the air. This destroys rats and insects : and will it is claimed, destroy the plague-bacillus if the proportion of sulphuro-sulphuric anhydride be high enough.

(2.) Passage into holds of an incombustible mixture of carbon monoxide and carbon dioxide.

(3.) Carbonic acid in such proportion as to constitute 30 per cent. of the air in the ship.

The last two methods kill rodents, but do not claim to kill insects or the plague-bacillus.

EXTRACTS from the Quarantine Laws and Regulations of the United States, 1903.

DISINFECTANTS AUTHORISED BY THESE REGULATIONS AND THE PROPER METHODS OF GENERATING AND USING SAME.

(Physical Disinfectants.)

156. Burning. Of unquestioned efficiency, but seldom required.

157. Boiling. Very efficient and of wide range of applicability. The articles must be wholly immersed for not less than thirty minutes in water actually boiling (100° C.). The addition of 1 per cent. of carbonate of soda renders the process applicable to polished steel, cutting instruments, or tools.

158. Steam.

(*a*) Flowing steam (not under pressure). Flowing steam (not under pressure) when applied under suitable conditions is an efficient disinfecting agent. The exposure must be continued thirty minutes after the temperature has reached 100° C.

(*b*) Steam under pressure without vacuum. Steam under pressure will sterilize, provided that the process is continued twenty minutes after the pressure reaches 15 pounds per square inch. The air must be expelled from the apparatus at the beginning of the process. If impracticable to obtain the designated pressure, a longer exposure will accomplish the same result.

(*c*) Steam under pressure with vacuum. Steam in a special apparatus with vacuum attachment is the best method of applying steam under pressure, the object of the vacuum apparatus being to expel the air and to promote the penetration of the steam. The process is to be continued for twenty minutes after the pressure reaches 10 pounds to the square inch.

GASEOUS DISINFECTANTS.

159. Sulphur dioxide. Sulphur dioxide is efficient, but requires the presence of moisture. It is only a surface disinfectant, and is lacking in penetrating properties. An atmosphere containing 4·5 per cent. can be obtained by burning 5 pounds of sulphur per 1,000 cubic feet of space. This amount would require the evaporation or volatilization of about 1 pint of water. Under these conditions the time exposure should not be less than twenty-four hours for bacterial infections. A shorter time will suffice for fumigation necessary to kill mosquitoes and other vermin.

160. The sulphur may be burned in shallow iron pots (Dutch ovens) containing not more than 80 pounds of sulphur for each pot, and the pots should stand in vessels of water. The sulphur pots should be elevated from the bottom of

the compartment to be disinfected in order to obtain the maximum possible percentage of combustion of sulphur. The sulphur should be in a state of fine division, and ignition is best accomplished by alcohol; special care to be taken with this method to prevent damage to cargo of vessel by fire; or the sulphur may be burned in a special furnace, the sulphur dioxide being distributed by a power fan. This method is peculiarly applicable to cargo vessels.

161. Liquefied sulphur dioxide may be used for disinfection in place of sulphur dioxide generated as above, it being borne in mind that this process will require 2 pounds of the liquefied gas for each pound of sulphur as indicated in the above paragraphs.

162. Sulphur dioxide is especially applicable to the holds of vessels, or to freight cars and apartments that may be tightly closed and which do not contain objects injured by the gas. Sulphur dioxide bleaches fabrics or materials dyed with vegetable or aniline dyes. It destroys linen or cotton goods by rotting the fibre through the agency of the acids formed. It injures most metals. It is promptly destructive to all forms of animal life. This property renders it a valuable agent for the extermination of rats, insects, and other vermin.

Formaldehyde Gas.

163. Formaldehyde gas is effective if applied by one of the methods given below. Formaldehyde gas has the advantage as a disinfectant that it does not injure fabrics or most colours. It is not poisonous to the higher forms of animal life. It fails to kill vermin such as rats, mice, roaches, bedbugs, &c. The method is not applicable to the holds of large vessels. Formaldehyde is applicable to the disinfection of rooms, clothing, and fabrics, but should not be depended upon for bedding, upholstered furniture, and the like, when deep penetration is required.*

164. Many formaldehyde solutions do not contain 40 per cent. of formaldehyde, and all are apt to deteriorate with time. It is therefore necessary to use a quantity in excess of the amount prescribed in these regulations, unless the solution has been recently analyzed.

165. The following methods of evolving the gas may be used.

(*a*) Autoclave under pressure, 3 to 12 hours' exposure.

(*b*) Lamp or generator, 6 to 18 hours' exposure.

(*c*) Spraying, 12 to 24 hours' exposure.

(*d*) Formaldehyde and dry heat in partial vacuum, 1 hour's exposure.

166. The minimum number of hours' exposure as given above applies to empty rooms of tight construction containing smooth, hard, surfaces; the maximum number of hours' exposure applying in all cases to textiles and other articles of a similar kind requiring more or less penetration.

167. Autoclave under pressure. This method has considerable penetrating power when applied as detailed below. Rooms or apartments need no special preparation beyond the ordinary closing of doors and windows. Pasting, caulking, or chinking of ordinary cracks and crevices is not necessary. The doors of lockers and closets and the drawers of bureaus should be opened. In this apparatus use formalin (40 per cent.), with the addition of a neutral salt, such as calcium chloride (20 per cent.). The gas must be evolved under a pressure not less than 45 pounds. After the gas is separated from its watery solution the pressure may be allowed to fall and steam projected into the compartment to supply the necessary moisture. Use not less than 10 ounces of formalin per 1,000 cubic feet, and keep the room closed for three to 12 hours after the completion of the process. For large rooms the gas must be introduced at several points as far apart as possible. It is applicable to the disinfection of clothing and fabrics suspended loosely in such a manner that every article is freely accessible to the gas from all directions.

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* It should be noted that formaldehyde disinfection is more efficient in warm, moist, or still weather than in cold, dry, or windy weather.

168. Lamp or generator. This method requires an apparatus producing formaldehyde by a partial oxidation of wood alcohol, and in using it the room or apartment should be rendered as tight as practicable. Oxidize 24 ounces of wood alcohol per 1,000 cubic feet, and keep the room closed for six to 18 hours, in accordance with the provisions of paragraph 165. This method leaves little or no odour. When applied to clothing and textiles, the articles should be suspended in a tight room and so disposed as to permit free access of the gas. (See also Par. 166.) The wood alcohol should be of 95 per cent. strength, and should not contain more than 5 per cent. of acetone.

169. Spraying. The formalin (40 per cent.) should be sprayed on sheets suspended in the room in such a manner that the solution remains in small drops on the sheet. Spray not less than 10 ounces of formalin (40 per cent.) for each 1,000 cubic feet. Used in this way a sheet will hold about 5 ounces without dripping or the drops running together. The room must be very tightly sealed in disinfecting with this process, and kept closed not less than 12 hours. The method is limited to rooms or apartments not exceeding 2,000 cubic feet. The formalin may also be sprayed upon the walls, floors, and objects in the rooms.

170. Formaldehyde with dry heat in partial vacuum. This method has superior penetrating powers and is specially applicable to clothing and baggage. The requirements of this method are (1) dry heat of 60° C. sustained for one hour; (2) a vacuum of 15 inches; (3) formaldehyde evolved from a mixture of formalin with a neutral salt, in an autoclave under pressure, using not less than 30 ounces of formalin (40 per cent.) for 1,000 cubic feet; and (4) a total exposure, under those combined conditions, of one hour.

171. The stated times of exposure to sulphur dioxide and formaldehyde are sufficient to destroy bacterial infection due to non-spore-bearing organisms, provided that the infection is present on the surface. If the room is of peculiar construction, so as to impede the diffusion of the gas, or if the room is a dirty one, or if on account of any other condition rendering the germicidal action of the gas more difficult, the time of exposure should be proportionately increased, or supplanted by other methods.

Chemical Solutions.

172. Bichloride of mercury. Bichloride of mercury is a disinfectant of undoubted potency and wide range of applicability. It cannot be depended upon to penetrate substances in the presence of albuminous matter. It should be used in solutions of 1 to 1,000. The solubility of bichloride of mercury may be increased by using sea water for the solution, or by adding 2 parts per 1,000 of sodium or ammonium chloride to the water employed.

173. Carbolic acid. Carbolic acid in the strength of 5 per cent. (See par. 51) may be substituted for the bichloride of mercury, and should be employed in the disinfection of the cabins and living apartments of ships to obviate injurious action on polished metals, bright work, &c.

174. Formalin. Formalin containing 40 per cent. of Formaldehyde may be used in a 5 per cent. solution as a substitute for bichloride of mercury or carbolic acid, and is useful for the disinfection of surfaces, dejecta, fabrics, and a great variety of objects, owing to its non-injurious character.

Application of Disinfectants in Quarantine Work.

175. Hold of iron vessels, empty, shall be disinfected by either:—

(*a*) Sulphur dioxide generated by burning sulphur 5 pounds per 1,000 cubic feet of air space, or liberated from 10 pounds of liquid sulphur dioxide, sufficient moisture being present in both cases; time of exposure 24 hours. (See Par. 159.)

(*b*) Washing with a solution of bichloride of mercury, 1 : 1,000.

176. Holds of wooden vessels, empty, shall be disinfected by:—

(*a*) Sulphur dioxide in the manner prescribed above, followed by

(*b*) Washing with a solution of bichloride of mercury.

177. In the case of all vessels, both iron and wooden, when treated for yellow fever or plague infection, the first process shall be preliminary fumigation by sulphur dioxide in the manner previously stated in paragraphs 159—161, in order to insure the destruction of mosquitoes, rats, and other vermin.

178. Holds of cargo vessels, when cargo can not be removed, shall be disinfected in so far as possible by sulphur dioxide not less than 4 per cent. per volume strength, and where possible this should be generated from a furnace to minimise danger of fire in cargo.

179. Living apartments, cabins, and forecastle of vessels shall be disinfected by one or more of the following methods:—

(*a*) Sulphur dioxide. The destructive action of the gas on property borne in mind.

(*b*) Formaldehyde gas.

(*c*) Washing with solution of bichloride of mercury, 1 : 1,000 or 5 per cent. solution of formalin, or 5 per cent. solution of carbolic acid, preference being given to carbolic acid for application to polished woods, bright metals, and other objects injured by metallic salts.

The forecastle, steerage, and other living apartments in bad sanitary condition must be disinfected by method (*a*) followed by method (*c*).

180. Mattresses, pillows, and heavy fabrics are to be disinfected by:—

(*a*) Boiling.

(*b*) Flowing steam, *i.e.*, steam not under pressure.

(*c*) Steam under pressure.

(*d*) Steam in a special apparatus with vacuum attachment.

181. Clothing, fabrics, textiles, curtains, hangings, &c., may be treated by either of the above methods from (*a*) to (*d*) inclusive, as circumstances may demand, or by formaldehyde gas or sulphur dioxide where the article is of a character which will not be damaged by sulphur dioxide.

182. Articles injured by steam, such as leather, furs, skins, rubber, trunks, valises, hats and caps, bound books, silks, and fine woollens, should not be disinfected by steam. Such articles should be disinfected by formaldehyde gas or by any of the agents allowed in these regulations which may be applicable thereto. Those which will be injured by wetting, should be disinfected by a gaseous agent.

183. Clothing, textiles and baggage, clean and in good condition, but suspected of infection can be efficiently and least injuriously disinfected by formaldehyde gas, generated by one of the methods prescribed in paragraph 165—(*a*), (*b*), or (*d*).

184. Textiles which are soiled with the discharges of the sick or presumably are deeply infected, must be disinfected by:—

(*a*) Boiling.

(*b*) Steam.

(*c*) Immersion in one of the germicidal solutions.

185. Cooking and eating utensils are always to be disinfected by immersion in boiling water or by steam.

EXTRACT from Section 104.

In cabins containing articles liable to damage by sulphur dioxide, pyrethrum powder may be burned instead.

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Section 134.

134. As soon as practicable, there shall be a preliminary disinfection with sulphur dioxide for the purpose of killing rats and vermin, before further disinfecting processes are applied to the vessel and her cargo. The killing of any escaping rats shall be provided for by a water guard in small boats, and no persons with abrasion or open sores should be employed in the handling of the vessel or her cargo.

Section 135.

135. The vessel should be submitted to a simultaneous disinfection in all parts with sulphur dioxide to ensure the destruction of rats and vermin. The rats shall be subsequently gathered and burned, due precautions being taken not to touch them with the bare hands, and the places where found disinfected with a germicidal solution; and the quarantine officer shall assure himself that the vessel is free of rats and vermin before granting free pratique.

Section 13.

13. At ports where yellow fever prevails * * * * * precautions should be taken to prevent the introduction of mosquitoes on board the vessel. Water tanks, water buckets and other collections of water about the vessel should be guarded in such a manner that they shall not become breeding places for mosquitoes. Measures should also be taken to destroy mosquitoes that may come on board.

Section 14.

14. At ports or places where plague prevails, every precaution must be taken to prevent the vessel becoming infected through the agency of rats, * * * * At such ports or places the vessel should not lie at a dock, or tie to the shore, or anchor near any place where such animals (*rats*) may gain access to the vessel. In case cables are led to the shore they should be freshly tarred and provided with inverted cones or such other devices as may prevent rats * * * * passing to the ship. The introduction of vermin on board the vessel from lighters and all other sources should be guarded against.

YELLOW FEVER.

EXTRACTS from the Public Health Reports of the United States, and from a paper by Dr. Juan Guiteras.

The following paper read by Dr Juan Guiteras is herewith published as narrating in detail the methods successfully adopted for the prevention of the spread of yellow fever in Havana. The paper may be considered one of practical value for use at any port or place where yellow fever may exist, whether in epidemic or sporadic form.—(*U.S. Public Health Reports*, 31*st July*, 1903.)

The procedure in the case of yellow fever is as follows:—The room occupied by the patient is at once closed by wire gauze. False windows and doors of all sizes are provided by the department, and they are at once adjusted to the openings in the room. One person, as nurse, is allowed to remain in the room, and a guard is placed at the wire-gauze door. The latter and other openings that may communicate with other apartments in the house are temporarily closed with stout manila paper in order to prevent the entrance of pyrethrum smoke in the room occupied by the patient. The rest of the house is now fumigated. To do this all compartments are carefully closed. Strips of paper are pasted over all cracks. Even open halls and courts are closed with screens of manila paper. A good deal of ingenuity is displayed in rapidly constructing and putting together these improvised screens, so that the most irregular and open places are converted into closed chambers hermetically sealed against the exit of smoke and mosquitoes.

After the fumigation of the house the patient is transferred to one of the fumigated rooms, previously closed with wire gauze, and the sick chamber is then disinfected in the same manner. Neighbouring houses, unless evidently

not in communication with the infected house, are treated in the same way. As previously stated, the process is often much simplified by removing the patient to Las Animas Hospital.

The routine of disinfection is as follows:—The inspector or chief of the squad assigns one man to each of the windows or openings in the room. The duty of each man is to close the openings perfectly by pasting strips of newspaper over all cracks and joints. Upon completing his work he must write his initials on the window frame. While this is being done the inspector has measured the cubic space of the room. If possible an opening is left somewhere for the admission of light; it may be a glass pane or an opening covered with manila paper. On the window sill or floor beneath this opening a sheet of moistened white paper is placed. It has been found that the mosquitoes, during the fumigation, flock toward this opening, and when paralysed by the smoke they are apt to fall upon the paper below, where they can be more easily gathered afterwards. The pyrethrum powder is now placed in pans and ignited by setting fire to a small amount of alcohol in each pan. One door has been left open for the exit of the men. Before leaving, all clothing is shaken and scattered about the room. The exit door is now closed from the outside, its joints and cracks are pasted over and the seal of the department is placed upon the strips of paper. Pyrethrum is burned in the proportion of 1 pound to every 1,000 cubic feet of space.

At the expiration of four hours the squad returns and the door is partially opened to allow the men to enter. The walls, ceiling, and floor are carefully swept, and the clothing is once more shaken. Any mosquitoes found to be still living are thrown into the pans and those that are dead are kept in small boxes to be sent to the laboratory of Las Animas Hospital for identification.

Petroleum is now poured into all receptacles where mosquito larvæ may grow. The inspector meanwhile makes an enquiry as to the place where the patient may have been infected, the places he visited in the last five days previous to his illness, and the persons that are likely to have been bitten at the same time and place with the patient.

The inspector takes also a census of the nonimmunes who live in the house and its immediate neighbourhood. All this information is made the subject of a report to the city health officer. The report should contain also any recommendations that may be deemed useful as to the general sanitary condition of the house.

The Health department of Havana is prepared to disinfect, in the manner above described, 24 houses in one day. As many as 22 have been disinfected with an expenditure of 500 pounds of pyrethrum.

Before leaving the house a certificate is obtained from the family to the effect that no damage has been done to the property in the process of disinfection, or, if otherwise, a note is taken of complaints that may be made.

With respect to the pyrethrum powder, it should be stated that the smoke does not kill all the mosquitoes; but at the end of four hours those that are not killed are paralyzed and can be readily gathered in the manner I have described. The smoke produces also a very faint cast upon exposed surfaces of white goods when they are lying in a horizontal position. Tobacco is as effective as pyrethrum, but it leaves a very offensive odour and a more decided stain than pyrethrum. Guava leaves have also been tried, but they are less effective.

No. 3.

APP. A, No. 3.

Summary of the Work of the Medical Inspectors in 1904.

*SUMMARY of the WORK of the MEDICAL INSPECTORS during the YEAR 1904.

A. DISEASE AND SANITARY ADMINISTRATION.

The following sanitary districts were visited by the Medical Inspectors with special reference to outbreaks of infectious disease of one and another sort, and to general sanitary circumstances and administration, viz. :—

Name of District.	Nature of Inquiry.
Aylesbury, R.D.	Small-pox outbreak among navvies.
†Beverley, U.D.	Enteric fever and diarrhœa; sanitary state and administration.
Chapel-en-le-Frith, R.D.	Sanitary administration with reference to small-pox.
Derby, U.D.	Do. do.
††Dewsbury, U.D. (2)	Do. do.
†Doncaster, R.D.	Enteric fever at Denaby Main.
†Durham, R.D.	Sanitary state and administration.
†Eaton Bray, R.D.	Enteric fever at Eaton Bray.
††Felling, U.D.	Small-pox in relation to Sheriff Hill Hospital, 1903–4.
Gateshead, U.D. (2)	Sanitary administration with reference to small-pox.
†† Do. do.	Small-pox in relation to Sheriff Hill Hospital, 1903–4.
Goole, U.D.	Sanitary administration with reference to small-pox.
†Halstead, R.D.	Sanitary state and administration.
†Hanley, U.D.	Infectious disease; sanitary state and administration.
†Haverfordwest, R.D.	Sanitary state and administration.
†Hayle, U.D.	Do. do.

* Throughout this summary the following abbreviations are used :—U.D. = a Borough or Urban District; R.D. = Rural District; P.S.D. = Port Sanitary District; Jt.H.D. = A Joint District for hospital purposes, formed under the Public Health Act, 1875, or the Isolation Hospitals Acts, 1893 and 1901.

† *See* Appendix A, No. 4, p. 72.

‡ The reports on these districts are reproduced in full in this volume, *see* Appendix A, Nos. 5 to 10.

A. Disease and Sanitary Administration—*continued.*

Name of District.	Nature of Inquiry.
†Hexham, R.D.	Infectious disease; sanitary state and administration of Bywell Registration Sub-district.
†Howden, R.D.	Sanitary state and administration.
†Isle of Wight, R.D.	Sanitary administration.
†Kingsclere, R.D.	Diphtheria.
Leek, R.D.	Sanitary administration with reference to small-pox.
Leek, U.D.	Do. do.
‡†Liverpool, U.D.	Small-pox in relation to small-pox hospitals, 1902–03.
†Liversedge, U.D.	Sanitary administration with reference to small-pox.
Loughborough, U.D.	Do. do.
†Ludgvan, U.D.	Sanitary state and administration.
†Madron, U.D.	Do. do.
Mirfield, U.D.	Sanitary administration with reference to small-pox.
†Nantyglo and Blaina, U.D.	Infectious disease; sanitary state and administration.
†Newtown and Llanidloes, R.D.	Sanitary state and administration.
Nottingham, U.D.	Sanitary administration with reference to small-pox.
†Ossett, U.D. (2)	Do. do.
†Paul, U.D.	Sanitary state and administration.
†Penzance, U.D.	Do. do.
†Pewsey, R.D.	Do. do.
‡†Prescall-with-Hackinsall, U.D.	Do. do.
†Ravensthorpe, U.D. (3)	Sanitary administration with reference to small-pox.
†St. Ives (Cornwall), U.D.	Sanitary state and administration.
†St. Just, U.D.	Do. do.
St. Thomas, R.D.	Repeated appearance of enteric fever at Byteign Cottage, Christow.
‡†Sheerness, U.D.	Enteric fever; sanitary state and administration.
†Soothill Nether, U.D. (2)...	Sanitary administration with reference to small-pox.
†Soothill Upper, U.D.	Do. do.

† *See* Appendix A, No. 4, p. 72.

‡ The reports on these districts are reproduced in full in this volume, *see* Appendix A, Nos. 5 to 10.

A. DISEASE AND SANITARY ADMINISTRATION—*continued.*

Name of District.	Nature of Inquiry.
†Thornhill, U.D.	Sanitary administration with reference to small-pox.
†West Penwith, R.D.	Sanitary state and administration.
†Windsor, R.D.	Enteric fever at Clewer Green.
†Wing, R.D.	Enteric fever at Edlesborough.

B. HOSPITALS, &c.

Local inquiries were held by the Medical Inspectors with reference to the provision of hospital accommodation for the isolation of cases of infectious disease in connection with the following districts :—

Acton, U.D. (2).
Arundel, U.D.
Ashton-in-Makerfield, U.D.
Ashton-under-Lyne District, Jt.H.D.
Barnes, U.D.
Blackpool, U.D.
Blaydon, Ryton, and Whickham, Jt.H.D.
Bolton-upon-Dearne, U.D.
Bristol, U.D.
Bromley and Beckenham, Jt.H.D.
Bury and District, Jt.H.D.
Caerphilly, U.D.
Carlisle, U.D.
Chelmsford, Jt.H.D. (2).
Congleton and District, Jt.H.D.
Croydon, R.D.
Darlington, U.D.
Dartford, R.D. and U.D.
Dover, U.D.
Dunmow, R.D.
Ealing, U.D.
Eastbourne, U.D.
Falmouth, U.D.
Fylde, Jt.H.D.
Gosforth, Newburn, and Castle Ward, Jt.H.D.
Gower, Jt.H.D.
Guildford, Godalming, and Woking, Jt.H.D.
Harrow-on-the-Hill, U.D.
Hindley, U.D.
Hitchin, Jt.H.D.
Hornsey, U.D.
Knighton and Teme, Jt.H.D.
Lanchester, Jt.H.D.
Leeds, U.D.
Leigh, Jt.H.D.
Merthyr Tydfil, U.D.

† *See* Appendix A, No. 4, p. 72.
‡ The reports on these districts are reproduced in full in this volume, *see* Appendix A, Nos. 5 to 10.

B. Hospitals, &c.—*continued.*

Newark, U.D.
Newcastle-under-Lyme, U.D.
Newhaven, U.D.
Newport (Mon.), U.D.
North-East Durham, Jt.H.D.
Northwich Rural and Northwich, Middlewich, and Winsford Urban, Jt.H.D.
Ongar, R.D.
Orsett, Jt.H.D.
Portsmouth, U.D.
Rochford, R.D.
Rotherham, U.D.
Rugby, Jt.H.D.
Runcorn, R.D.
Scarborough, U.D.
Sedgefield, Jt.H.D.
Settle, R.D.
Southampton, U.D.
South Staffordshire, Jt.H.D.
Stockport, U.D.
Stone, Jt.H.D. (2)
Teignmouth, U.D.
Todmorden, U.D.
Tolworth, Jt.H.D.
Wakefield, R.D.
Wallasey, U.D.
Waltham, Jt.H.D.
Walthamstow, U.D.
Wanstead, U.D., and Woodford, U.D.
Watford, Jt.H.D.
Wath, Swinton, and District, Jt.H.D.
Whickham, U.D.
Whitchurch and District, Jt.H.D. (2).
Willesden, U.D.

Inquiries were held as to the provision of mortuary and ambulance accommodation for Walthamstow, U.D.; of a disinfector and building for Lytham, U.D.; of a disinfecting station for Wandsworth; of land for refuse destructor and depôt for Weston-super-Mare, U.D.; and of an outbathing station and ambulance shed for Southampton, U.D.

C. Sewerage and Sewage Disposal.

Inquiries in this connection were held as follows:—

Bingley, U.D.
Bournemouth, U.D.
Deudraeth, R.D. (Minffordd).
Huddersfield, U.D.
Portsmouth, U.D.
Sheffield, U.D.

D. Water Supply.

Inquiries were held into the water supply of the following districts:—

Bedford, U.D.
"Holderness Area."
Isle of Wight, R.D. (R. Yar).
Kempston, U.D.
Sandown, U.D.

App. A, No. 3. Summary of the Work of the Medical Inspectors in 1904.

The Holderness Area inquiry had concern with the following districts :—

Beverley, U.D.	Beverley, R.D.
Hedon, U.D.	Patrington, R.D.
Hornsea, U.D.	Sculcoates, R.D.
Withernsea, U.D.	Skirlaugh, R.D.

E. Byelaws.

Inquiries with reference to byelaws were held as follows :—

Christchurch, R.D.	Portsmouth, U.D.
Flaxton, R.D.	

F. Scavenging.

Under this head inquiries were made at :—

Godstone, R.D.	Weardale, R.D.

G. Vaccination Inspection.

In addition to the routine inspection of vaccination in England and Wales (App. A, No. 12), special visits by Medical Inspectors with reference to vaccination administration were made to the Unions mentioned below. The visits to those Unions indicated in italics were made owing to the prevalence of small-pox in the Union :—

Aylesbury.	Haltwhistle.
Camberwell.	Hexham.
Cheltenham.	Isle of Thanet.
Chippenham.	*Leek.*
Croydon.	*Loughborough.*
Derby.	Malmesbury.
Devonport.	North Bierley.
Dewsbury (2).	*Nottingham.*
Dulverton.	Poplar.
Gateshead (3).	*Tynemouth.*
Greenwich.	Wandsworth.

H. Plague Precautions.

A case of suspected plague was locally investigated in :—

R. Tyne P.S.D.

I. Conferences with Local Officials.

Conferences on sanitary matters were held locally with various officials of the following districts :—

Auckland, R.D.	Fowey, P.S.D.
Chepstow, P.S.D.	Harwich, P.S.D.
Dover, U.D.	Paddington, U.D.
Durham, R.D.	Ryde, U.D.
Falmouth and Truro, P.S.D.	Sleaford, R.D.

J. Miscellaneous.

Dr. Bulstrode has continued further his general inquiries into sanatoria for consumptives, and into oyster and other shell-fish layings with reference to their liability to pollution by sewage. He held an inquiry into an application by the East Sussex County Council for an order under section 20, Rivers Pollution Prevention Act, 1876, determining a portion of the tidal waters of the River Ouse a "stream." He held a local inquiry in the Docking, R.D., as to the risk of pollution of shell-fish beds by discharge from a sewage outfall at Brancaster, and a similar inquiry in the Wirral, R.D., as to possible pollution of shell-fish beds in the Dee Estuary from a proposed outfall at Gayton.

Dr. Reece held local conferences with officers of H.M. Customs and local sanitary officials with reference to arrangements of one and another kind for dealing with vessels arriving with cases of infectious disease on board; Dr. Reece visited in this connection the following Port Sanitary Districts :—

Bristol, Cardiff, Hull, Liverpool, and Southampton.

Dr. Buchanan attended a conference of representatives of local authorities interested in the Faversham, P.S.D.. with reference to suitable arrangements for discharging the duties of Medical Officer of Health, and Inspector of Nuisances, and generally as to the constitution of the P.S.D.

Dr. Manby has from time to time, as occasion served, continued his inspection of cow-sheds in different parts of the country with special reference to the actual housing of the cows and the

App. A, No. 3. Summary of the Work of the Medical Inspectors in 1904.

lighting and ventilation of the sheds. During the course of his inquiry he visited sheds in the following districts :—

Urban Districts.	Rural Districts.
Bradford.	Andover.
Chertsey.	Chertsey.
Harrow.	Cricklade and Wootton Bassett.
Liverpool.	Croydon.
Manchester.	Dulverton.
Southampton.	Gloucester.
Weybridge.	Guildford.
Woking.	Highworth.
	Kingsclere.
	Wetherby.

K. Inquiries by the Assistant Inspector in the Medical Department.

Mr. Huddart inquired into the arrangements for the performance of the duties of nuisance inspector in the following districts :—

Aberavon, U.D.	Narberth, R.D.
Arundel, U.D.	Narberth, U.D.
Basford, R.D.	Penrith, R.D.
Billericay, R.D.	Penryn, U.D.
Bridport, R.D.	Peterborough, U.D.
Chester-le-Street, R.D.	Pocklington, R.D.
Easingwold, R.D.	Rhayader, R.D.
Gildersome, U.D.	Staines, R.D.
Great Harwood, U.D.	Steyning West, R.D.
Kendal, U.D.	Taunton, R.D.
Maidenhead, U.D.	Thrapston, R.D.
Matlock, U.D.	Thurlstone, U.D.
Monmouth, U.D.	Totnes, R.D.
Morpeth, U.D.	Walsingham, R.D.

Mr. Huddart also visited the Unions named below as to the administration of the Vaccination Acts, and especially as to the performance of duty by the Vaccination Officers :—

Ashbourne.	Basford.
Ashby-de-la-Zouch.	Chepstow.
Barrow-on-Soar.	Colchester.

K. INQUIRIES BY ASSISTANT INSPECTOR—*continued.*

Dudley.	Seisdon.
Gainsborough.	Skipton.
Gateshead.	Southwell.
Guisborough.	Stoke-upon-Trent.
Hexham.	Sunderland.
Keighley.	Tamworth.
Mansfield (2).	Trowbridge and Melksham.
North Bierley.	Wellingborough.
Pontypool.	Wharfedale.
Reading.	Wolverhampton.
Rugby.	

Mr. Huddart also visited Bradford, Leeds, and Sheffield, with reference to the recovery of fines inflicted as a result of prosecutions under the Vaccination Acts.

No. 4.

PP. A, No. 4. Extract of Medical Inspections.

ABSTRACT of MEDICAL INSPECTIONS made in 1904 with regard to the INCIDENCE of DISEASE on particular places, and to questions concerning LOCAL SANITARY ADMINISTRATION.

[*Where price is given the report can be obtained from Messrs. Wyman & Son, 109, Fetter Lane, Fleet Street, E.C., or other agents for Government publications. The reports relating to districts indicated by an asterisk are reproduced in this volume, see App. A, Nos. 5 to 10.*]

1. BEVERLEY (YORKS, EAST RIDING); Population (1901), 13,183; Dr. Farrar. [No. 205, Price 4*d.*]

Authority concerned: Beverley Town Council.

Ground of Inquiry: Recent prevalence of enteric fever and diarrhœa in borough.

Chief Facts reported by Inspector: Prevalence in May 1904 of diarrhœa. About 400 cases, of which 200 were medically attended, were almost entirely among families using Beverley Waterworks Company's water, and in East Riding Asylum and East Yorkshire Regimental Barracks using same supply. (Waterworks Company supply about one-third of houses in town.) Prevalence of enteric fever followed in June; 32 cases, almost entirely among users of Waterworks Company's supply. Company's well regarded as liable to serious contamination through fissures in chalk. Need, therefore, for safeguarding this well and for filtration of the well water.

2. DENABY MAIN IN DONCASTER RURAL DISTRICT (YORKS, WEST RIDING); population, 8,320; Dr. Farrar. [No. 216, Price 9*d.*]

Authority concerned: Doncaster Rural District Council.

Ground of Inquiry: Outbreak of enteric fever at Denaby Main.

Chief Facts reported by Inspector: Sixty cases enteric fever in New Conisborough between July 16th and October 22nd; 25 cases in Denaby between August 16th and October 7th. Water supply not to be regarded as incriminated. No reason to suspect milk or any other article of diet. Of the 60 cases at New Conisborough 55 occurred in or could be traced directly to two streets, Balby Street and Blythe Street. Of the 25 cases in Denaby, 24 occurred within a limited area, mostly in Barmborough Street.

Middens considered an important factor in the spread of infection in this outbreak. Infected excreta deposited on a particular group of middens for several days without any attempt at disinfection. Remarkable prevalence locally of flies during August; and possible agency of these insects in conveyance of infection from middens to food. The enteric fever outbreak coincident with a remarkable prevalence of epidemic diarrhœa among infants in the same neighbourhood.

Neglect of supervision of scavenging and of issue of disinfectants by Inspector of Nuisances.

3. *DEWSBURY BOROUGH (YORKS, WEST RIDING); population (1901), 28,060; Dr. Wheaton. [No. 204, Price 3*d.*]

Authority concerned: Dewsbury Town Council.

Ground of Inquiry: Prevalence of small-pox.

Chief Facts reported by Inspector: In 1904, up to date of visit on September 14th, 260 attacks of small-pox had occurred; 152 additional cases reported between that date and October 21st. For a long time the town had been the centre of a movement hostile to vaccination, in which the surrounding urban districts had participated. Dewsbury Guardians had not only neglected their duties under the Vaccination Acts, but had taken up an attitude of opposition to them, although repeatedly urged by the Board to give effect to their provisions. The Town Council had provided a hospital of a temporary nature, the condition of which was very unsatisfactory; it was dirty, dilapidated and overcrowded. They had promised the use of this hospital to surrounding districts, but on the outbreak of small-pox had soon to refuse admittance to cases coming from outside their town. A Joint Hospital Board had been formed, but had provided no small-pox hospital. The hospital probably acted as a centre from which the infection was disseminated. A new temporary hospital was destroyed by fire. Disinfection, of dwellings and of clothing of contacts, unsatisfactory. No provision for the accommodation of contacts whilst their dwellings were disinfected. The Guardians having taken no action for promoting vaccination, the Board issued an Order under sections 130 and 134, of the Public Health Act, 1875, requiring the Town Council, among other matters, to provide a vaccination centre or centres for free vaccination and revaccination.

4. DURHAM RURAL DISTRICT; population (1901), 28,482; Dr. Farrar. [No. 213, Price 3*d.*]

Authority concerned: Durham Rural District Council.

Ground of Inquiry: Application to sanction appointment involving continuance of two Medical Officers of Health in this district.

Chief Facts reported by Inspector: Water supply principally from Weardale and Consett Water Company. District on the whole well and efficiently sewered. Large combined ashpit and midden privy in general use throughout the district. Scavenging of these receptacles in many cases neglected. Some of the privies in ruinous condition. Houses in certain villages badly built, damp, and in bad repair. Streets in colliery villages not made up and in very bad condition. More effective provision needed for isolation of infectious diseases, particularly of small-pox. Inspector's opinion that a single Medical Officer of Health engaged in general practice could take charge of whole district, and that the services of a competent single Medical Officer of Health could be secured for an annual sum not largely in excess of that now expended by the Rural District Council in salaries to their present officers.

5. EATON BRAY VILLAGE (BEDFORDSHIRE); population (1901), 1,000; Dr. Sweeting. [No. 203, Price 3*d.*]

Authority concerned: Eaton Bray Rural District Council.

Ground of Inquiry: Outbreak of enteric fever.

Chief Facts reported by Inspector: Localised incidence of enteric fever here and at Edlesborough village continuous with it (q.v.). Thirty-three cases in the six weeks ended August 19th, and ten of them in the period July 9th to 12th. Disease almost entirely confined to children attending Edlesborough National School. Facts of outbreak most consistent with a hypothesis of the water of a shallow well at this school having been rendered infective by washing into it of excrement from the school closets some three or four weeks before the outbreak of enteric fever. The source of the specific contagion could not, however, be traced.

Notification of cases to the Medical Officer of Health delayed. No hospital provision. Imperfect disinfection of linen and bedding. Public water supply and sewerage recommended.

6. EDLESBOROUGH VILLAGE (BUCKS); population (1901), 400; Dr. Sweeting. [No. 203, Price 3*d.*]

Authority concerned: Wing Rural District Council.

Ground of Inquiry: Outbreak of enteric fever.

Chief Facts reported by Inspector: Localised incidence of enteric fever here and at Eaton Bray Village continuous with it. (*See* Eaton Bray *précis.*)

Notification of cases to the Medical Officer of Health delayed. Hospital isolation little used, though available. Imperfect disinfection of linen and bedding. Public

water supply, sewerage, and systematic scavenging recommended.

7. *GATESHEAD COUNTY BOROUGH; population (1901), 109,888; FELLING URBAN DISTRICT (DURHAM); population (1901), 22,467; Dr. Buchanan. [No. 202, Price 8*d.*]

Authorities concerned: Gateshead Town Council; Felling Urban District Council.

Ground of Inquiry: Prevalence of small-pox in relation to Sheriff Hill Hospital, Gateshead.

Chief Facts reported by Inspector: Small-pox prevalent in both districts from April, 1903, to May, 1904. Exceptional incidence on certain inhabited areas, partly in Felling and partly in Gateshead, which were near to the Sheriff Hill Hospital, in which Gateshead small-pox cases were isolated. Inquiries made in detail as to this exceptional incidence, its duration, extent, cause, and relations to the hospital. Conclusion that this hospital exercised a material effect in enhancing and maintaining the prevalence of small-pox in both districts.

8. HALSTEAD RURAL DISTRICT (ESSEX); population (1901). 10,176; Dr. Fletcher. [No. 211, Price 3*d.*]

Authority concerned: Halstead Rural District Council.

Ground of Inquiry: Doubts as to efficiency of Sanitary Administration and Staff.

Chief Facts reported by Inspector: Water-supply almost entirely from wells, many of which are public. Considerable efforts have been made to improve and safeguard these public wells. Deficient and suspicious supplies from certain private wells. No proper drainage system in the district. Several dilapidated dwelling-houses. Privy cesspits in common use, and some handflushed w.c's., the former generally a nuisance, and the latter frequently neglected and filthy. No public scavenging. Provision made for hospital isolation. Conclusion that District Council willing to take necessary action in sanitary matters, but lacks the advice of capable officers.

9. COUNTY BOROUGH OF HANLEY; population (1901), 61,599; Dr. Copeman. [No. 217, Price 1*s.* 6*d.*]

Authority concerned: Hanley Town Council.

Ground of Inquiry: Continued heavy incidence of zymotic disease, more especially scarlet fever, diphtheria, enteric fever and diarrhœa (zymotic enteritis) and a persistently high infantile mortality-rate.

Chief Facts reported by Inspector: Scarlet fever still prevalent but of mild type, comparatively few deaths

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having occurred. Diarrhœa, which during last five years has headed list of deaths from zymotic diseases in Hanley, due in part, at any rate, to excessive employment of adult female labour in the Potteries, and consequent artificial feeding of infants. Sanitary defects, details of which are given in report, probably also to some extent responsible. Diphtheria, which since 1896 has gradually spread from south to north along the line of Pottery Towns, mainly conveyed by association of children in public elementary schools. Enteric fever for many years past has been to some extent endemic, but from 1899 onwards deaths have diminished year by year. No one portion of the town specially affected and no evidence of implication of water or milk supply.

Isolation hospital at Bucknall, managed by the Hanley, Stoke, Fenton and Longton Joint Hospital Board, but no accommodation provided for enteric fever cases. Arrangements for disinfection satisfactory. Byelaws in force antiquated and insufficient. New series under consideration by Town Council, but their adoption and enforcement unduly delayed.

10. HAVERFORDWEST RURAL DISTRICT (PEMBROKESHIRE); population (1901), 22,014; Dr. Spencer Low. [No. 209, Price One Shilling.]

Authority concerned: Haverfordwest Rural District Council.

Ground of Inquiry: Doubt as to efficiency of sanitary administration.

Chief Facts reported by Inspector: Various unhealthy conditions of and about dwellings; absence in places of proper sewerage and water supply, as well as of scavenging in the more populous centres. No permanent hospital accommodation for the isolation of infectious disease. Need of greater attention by District Council to sanitary matters. Appointment of a single Medical Officer of Health in place of four medical practitioners as at present, and of an additional Inspector of Nuisances recommended.

11. HAYLE URBAN DISTRICT (CORNWALL); population (1901), 1,084; Dr. Spencer Low. [No. 200, Price One Shilling.]

Authority concerned: Hayle Urban District Council.

Ground of Inquiry: Annual Reports of Medical Officer of Health and other information.

Chief Facts reported by Inspector: Improvement in sanitary administration in late years. Matters requiring attention: Water supply, liable to pollution, and should, if possible, be filtered; closets without flushing apparatus; other nuisances. New building byelaws recommended.

12. Bywell Registration Sub-District of Hexham Rural District (Northumberland); population (1901), 13,160; Dr. Fletcher. [No 207, Price 6*d.*]

Authority concerned: Hexham Rural District Council.

Ground of Inquiry: Continued prevalence of infectious disease, more especially of diphtheria and scarlet fever. Petition for inspection by miners of West Wylam, Prudhoe, and Mickley Collieries.

Chief Facts reported by Inspector: Population of Bywell Sub-district nearly equal to that of the rest of Hexham Rural District. For ten years, 1894 to 1903, inclusive, incidence of diphtheria nine times as great in Bywell Sub-district as in the rest of the Rural District, and of scarlet fever twice as great. Both diseases exceptionally prevalent in 1902 and 1903 in the Bywell Sub-district.

Prevalence of infectious disease associated with insufficient house accommodation and insufficient accommodation for families in individual dwellings. Much overcrowding in houses, many gross instances. Schools generally overcrowded and insufficiently ventilated. Hospital accommodation quite inadequate; not used for diphtheria or scarlet fever. Most of the villages in Bywell Sub-district supplied with water by the Newcastle and Gateshead Water Company. Villages mostly drained to streams tributary to or directly into the River Tyne. Privy-ashpits in general use. Various administrative recommendations made.

13. Howden Rural District (Yorks, East Riding); population (1901), 12,274; Dr. Farrar. [No. 206 Price 3*d.*]

Authority concerned: Howden Rural District Council.

Ground of Inquiry: Questions as to water supply; sewerage; diphtheria prevalence. Complaints by County Council.

Chief Facts reported by Inspector: District consists of fen land covered with alluvial silt; great difficulty in obtaining pure water locally, the chief supplies being stored rain-water and shallow wells, which are generally grossly polluted. Recommended that a water-supply be obtained by gravitation from the chalk escarpment. Systems of sewerage required for Howden parish and some of the larger villages. More efficient scavenging required. Building byelaws suitable for a rural district needed.

14. Isle of Wight Rural District (Isle of Wight); population (1901), 28,559; Dr. Bulstrode. [No. 219, Price 6*d.*

Authority concerned: Isle of Wight Rural District Council

Ground of Inquiry: Unsatisfactory administrative procedure as regards appointment of Inspector of Nuisances.

Chief Facts reported by Inspector: Total area of district nearly equal to the County of Rutland, and the character of the population such as to necessitate constant sustained inspection. Numerous aggregations of population, in several instances quite urban in character. A large number of visitors during summer months. Practically no isolation accommodation and no disinfecting apparatus. Several satisfactory water supplies and sewerage systems in existence, but some parts of the district much in need of both. Four Inspectors of Nuisances each of whom also acted as Highway Surveyor, Sanitary Surveyor and Inspector of Petroleum. Greater portion of the time of each officer taken up with his duties of Highway Surveyor, and duties of Inspector of Nuisances relegated to a secondary position. Many nuisances and defects discovered; bye-laws and regulations not adequately enforced; cowsheds and bakehouses required more detailed attention. Need for more house to house inspection and more searching out of nuisances.

Inspector recommended that duties of the Inspectors of Nuisances should be entirely severed from those of Highway Surveyor.

15. KINGSCLERE RURAL DISTRICT (HANTS); population (1901), 8,500; Dr. Manby.

Authority concerned: Kingsclere Rural District Council.

Ground of Inquiry: Report of two cases of typhus fever in district—also continued prevalence of diphtheria.

Chief Facts reported by Inspector: First case considered typhus fever by Medical Officer of Health was more probably malignant diphtheria; recovery ensued. Second case agreed by all concerned to have been urticaria. Nine diphtheria cases notified in 1903 and 15 in 1904 to October 30th—13 of these 24 cases occurred in the parish of Burghclere, and six in Newtown parish. Unrecognised cases at beginning of the Burghclere outbreak. School and home association helped the spread of infection there and at Newtown. First case in each outbreak probably infected from outside the district. Two outbreaks not apparently connected. Attention drawn to insanitary conditions of district, which need attention.

16. *CITY OF LIVERPOOL; population, estimated, 723,430 (1904); Dr. Reece. [No. 208, Price 2*s.* 6*d.*]

Authority concerned: Liverpool City Council.

Ground of Inquiry: Epidemic small-pox during 1902–1903. Information required as to use and influence of the small-pox hospitals during the epidemic.

Chief Facts reported by Inspector: Extensive and severe epidemic of small-pox in Liverpool during 1902–3. Met by vigorous and well-organised action of sanitary department. Special arrangements for vaccination, along with almost universal acceptance of vaccination by the people, materially limited the amount of small-pox in the city. Three hospitals used for the reception of small-pox at Liverpool during 1902–3. At first a small hospital, Priory Road Hospital, within the city, alone was used. After about a year, when the cases of small-pox became too numerous to be received into this hospital, a large hospital, Park Hill Hospital, situated in a populous part of the city, and another at Fazakerley, in a sparsely populated district outside the city boundary, were opened for small-pox patients. Detailed study made of incidence of small-pox fortnight by fortnight on inhabited areas at different distances from each of these hospitals. Facts obtained set out in maps, diagrams, and tables. Conclusion that whether there be taken the large figures for the large hospital (Park Hill) at the height of the epidemic, or the smaller figures for the smaller hospital (Priory Road) in the early portion of the epidemic, or the figures for the outside (Fazakerley) hospital with comparatively few houses round it, each basis of consideration indicates in its degree and on the invasion rates, a specialized incidence of small-pox corresponding in point of time to the hospital operations. Where the figures are largest and the conclusions to be drawn from the rates are consequently the most definite, the indication of the excess of incidence of small-pox on the neighbourhood of the hospital, and the evidence of graduation in the intensity of such incidence, are clearly manifest.

17. *LIVERSEDGE URBAN DISTRICT (YORKSHIRE, WEST RIDING); population (1901), 13,980; Dr. Wheaton. [No. 204, Price 3*d.*]

Authority concerned: Liversedge Urban District Council.

Ground of Inquiry: Prevalence of small-pox.

Chief Facts reported by Inspector: At date of visit, October 4th, 1904, 34 cases of small-pox had occurred during the year, of which only four had been removed to hospital. An emergency temporary small-pox hospital provided by the Mirfield and Liversedge Joint Hospital Board was not opened until October. This hospital not of satisfactory construction, unfenced, and only 100 yards distant from the hospital for ordinary infectious diseases. No disinfection of clothing of contacts, no provision for their temporary accommodation whilst their dwellings were disinfected.

Although the district was one in which hostility to vaccination was common, vaccination and revaccination were in large measure accepted on the outbreak of small-pox.

18. LUDGVAN URBAN DISTRICT (CORNWALL); population (1901), 2,274; Dr. Spencer Low. [No. 200, Price One Shilling.]

Authority concerned: Ludgvan Urban District Council.

Ground of Inquiry: Annual Reports of Medical Officer of Health and other information.

Chief Facts reported by Inspector: Insanitary property, nuisances, and drainage require attention. No isolation hospital or disinfecting apparatus available. Dairies, Cowsheds and Milkshops Order not enforced. No bye-laws upon any subject. Much to be done before sanitary condition of the district attains even a minimum standard of efficiency.

19. MADRON URBAN DISTRICT (CORNWALL); population (1901), 3,486; Dr. Spencer Low. [No. 200, Price One Shilling.]

Authority concerned: Madron Urban District Council.

Ground of Inquiry: Annual Reports of Medical Officer of Health and other information.

Chief Facts reported by Inspector: Stream between Tolcarne and Newlyn much polluted; defective sewerage systems; insufficient inspection of cowsheds; no hospital isolation accommodation; condition and surroundings of certain dwellings unsatisfactory.

20. NANTYGLO AND BLAINA URBAN DISTRICT (MONMOUTH); population (1901), 13,489; Dr. Fletcher. [No. 212, Price 9*d.*]

Authority concerned: Nantyglo and Blaina Urban District Council.

Ground of Inquiry: Persistent prevalence of infectious disease, and especially of diphtheria during 1903.

Chief Facts reported by Inspector: During 4¾ years, January 1900 to September 1904, there were notified in this small district, 558 cases of scarlet fever, with 11 deaths; 1,174 cases of diphtheria and membranous croup, with only 47 deaths; and 207 cases of enteric fever with 29 deaths. Inspector concluded that many cases had been reported as diphtheria on insufficient evidence, and probably were not diphtheria.

Water supply from Ebbw Vale District Council's Waterworks. An old temporary isolation hospital not

used. A dwelling-house and grounds purchased for a new isolation hospital, but house so dilapidated as to be unfit for use, and incapable of conversion into a properly arranged hospital.

Unsatisfactory privies and w.c's. During recent years extensive conversion of privies into w.c's., conversion often obviously effected by unskilled hands. Sewers discharge by many outfalls directly into the River Ebbw Fach, but the district will eventually be drained by the Monmouthshire Western Valleys Sewerage Board. Attention drawn to unsatisfactory house accommodation. Various administrative recommendations made.

21. NEWTOWN AND LLANIDLOES RURAL DISTRICT (MONTGOMERYSHIRE); population (1901), 11,848; Dr. Farrar.

Authority concerned: Newtown and Llanidloes Rural District Council.

Ground of Inquiry: Dissatisfaction of Board with sanitary administration. Question of appointment of two Medical Officers of Health for the district.

Chief Facts reported by Inspector: Local water supplies subject to gross pollution (chiefly dip-wells and pumps from shallow wells). Reckless pollution of watercourses throughout district. Drainage inadequate. Privies allowed to become over-full. Privy arrangements in schools unsatisfactory. Scavenging neglected. Many houses insanitary owing to damp or proximity of undrained pig-styes, cattle-sheds, &c. No isolation hospital.

Two Medical Officers of Health. Inspector advised that appointment of a single medical practitioner as Medical Officer of Health would be preferable to present arrangement. Inspector of Nuisances has not adequately performed his duties.

22. *BOROUGH OF OSSETT (YORKS, WEST RIDING); population (1901), 12,903; Dr. Wheaton. [No. 204, Price 3*d.*]

Authority concerned: Town Council of Ossett.

Ground of Inquiry: Prevalence of small-pox.

Chief Facts reported by Inspector: Small-pox occurred in 1903, when 15 cases came under notice. In 1904, up to date of visit on October 5th, 62 cases had occurred. All the patients removed to a hospital in the borough which had at times become overcrowded. A disinfecting apparatus provided at the hospital. Administration by the Town Council unsatisfactory; disinfection of dwellings imperfect; no accommodation for "contacts" beyond a travelling van; no disinfection of clothing of "contacts." Hostility to vaccination very great in

the Borough, but "contacts" readily accepted vaccination or revaccination, and a large part of the population were seeking this protection from the disease, the public vaccinator performing 500 operations weekly.

23. PAUL URBAN DISTRICT (CORNWALL): population (1901), 6,332; Dr. Spencer Low. [No. 200, Price One Shilling.]

Authority concerned: Paul Urban District Council.

Ground of Inquiry: Annual Reports of Medical Officer of Health and other information.

Chief Facts reported by Inspector: Unsatisfactory water supply and sewerage in certain parts of district. Insufficient inspection of the district for the discovery and remedy of nuisances. Pollution of harbours and streams by excrement and refuse. Overcrowding of houses upon area and generally insanitary condition of Newlyn and Mousehole. Dairies, Cowsheds and Milkshops Order not enforced. Need for better administration by Council, and suggestions to this end.

24. BOROUGH OF PENZANCE (CORNWALL); population (1901), 13,136; Dr. Spencer Low. [No. 200, Price, One Shilling.]

Authority concerned: Penzance Town Council.

Ground of Inquiry: Annual Reports of Medical Officer of Health and other information.

Chief Facts reported by Inspector: Insufficient use made of isolation hospital in cases of scarlet fever and diphtheria which have been prevalent in the district; need for employment of bacteriological aids to diagnosis of diphtheria. Attention drawn to unwholesome condition of certain areas and dwellings, and to need of new byelaws.

25. PEWSEY RURAL DISTRICT (WILTS); population (1901) 11,211; Dr. Fletcher. [No. 214, Price 6*d.*]

Authority concerned: Pewsey Rural District Council.

Ground of Inquiry: Doubts as to proper sanitary supervision of the district.

Chief Facts reported by Inspector: Water supply generally unsatisfactory, especially at Pewsey itself and Ludgershall. No proper system of sewerage in the district. Privy nuisances abound. No hospital accommodation. Many dilapidated dwellings; thatched cottages in need of repair. Insufficient housing accommodation leading to overcrowding. District very largely given over to dairy-farming, the milk mostly coming to large London Dairy Companies; on 106 premises used for milk supply

purposes, 1,897 cows are kept. Medical Officer of Health only inspects dairy-farms supplying Aylesbury Dairy Company, receiving special fees for so doing. Neglect to keep register of cowkeepers and purveyors of milk, only two persons registered. Inspector of Nuisances holds so many offices that he has not sufficient time to devote to his duties in the above office. Evidence of general want of supervision and inspection by both Medical Officer of Health and Inspector of Nuisances.

26. *PREESALL-WITH-HACKINSALL URBAN DISTRICT (LANCASHIRE); population (1901), 1,423; Dr. Spencer Low. [No. 198, Price 2*d.*]

Authority concerned: Preesall-with-Hackinsall Urban District Council.

Ground of Inquiry: Statements in Annual Reports of Medical Officer of Health and local complaints.

Chief Facts reported by Inspector: Need for (1) provision of adequate supply of wholesome water; (2) remedy of faulty conditions of drainage, sewerage, and sewage disposal, as well as of excrement and refuse disposal; (3) isolation accommodation for infectious diseases other than small-pox; (4) systematic inspection of dairies, cowsheds, and milk-shops; (5) enforcement of existing bye-laws; (6) systematic inspection of the district for the discovery and remedy of nuisance.

27. *RAVENSTHORPE URBAN DISTRICT (YORKS, WEST RIDING); population (1901), 5,699; Dr. Wheaton. [No. 204, Price 3*d.*]

Authority concerned: Ravensthorpe Urban District Council.

Ground of Inquiry: Prevalence of small-pox.

Chief Facts reported by Inspector: At date of first visit, September 16th, 1904, 46 cases of small-pox had occurred during the year. The adjoining Borough of Dewsbury had promised to provide hospital accommodation for small-pox but had failed to do so. 16 cases were at that time retained in their homes. Spread of the disease attributed to the Dewsbury small-pox hospital, which was situate close to the boundary of the district. District, one in which hostility to vaccination had been for a long time rife. The Council had no disinfecting apparatus. No proper disinfection of invaded dwellings or of clothing of "contacts." No provision for temporary accommodation of "contacts" whilst their dwellings and clothing were disinfected. At a second visit, October 13th, 52 cases of small-pox were under treatment in their homes. No hospital provision. Reckless exposure of children to infection; healthy persons sleeping in the same beds as small-pox sufferers; great overcrowding of

patients in rooms; no nurses provided; deplorable condition of persons living in invaded houses. On October 31st the Board issued an Order under sections 130 and 134 of the Public Health Act, 1875, in similar terms to that issued in the case of Dewsbury.

28. BOROUGH OF ST. IVES (CORNWALL); population (1901), 6,699; Dr. Spencer Low. [No. 200, Price One Shilling.]

Authority concerned: St. Ives Town Council.

Ground of Inquiry: Annual Reports of Medical Officer of Health and other information.

Chief Facts reported by Inspector: Insanitary condition of some of the dwellings of poorer classes; overcrowding of houses upon area common; general lack of closet accommodation in congested areas, remedied to some extent by provision of public latrines; insufficient inspection of cowsheds; pollution of stream running through town by sewage and refuse. No isolation accommodation for infectious diseases or a steam disinfector.

29. ST. JUST URBAN DISTRICT (CORNWALL); population (1901), 5,646; Dr. Spencer Low. [No. 200, Price One Shilling.]

Authority concerned: St. Just Urban District Council.

Ground of Inquiry: Annual Reports of Medical Officer of Health and other information.

Chief Facts reported by Inspector: Water supply and sewerage unsatisfactory. Scavenging arrangements inefficient. Dairies, Cowsheds, and Milkshops Order not enforced. No byelaws. Attention drawn to condition of slaughter-houses and existence of various nuisances. Since its constitution in 1897 practically nothing has been done for the sanitary needs of the district, which abounds in accumulations of filth and refuse and in other insanitary conditions.

30. *SHEERNESS URBAN DISTRICT (KENT); population (1901), without garrisons, 14,293; Dr. Buchanan. [No. 215, Price 6*d.*]

Authority concerned: Sheerness Urban District Council.

Ground of Inquiry: Prevalence of enteric fever; want of information as to local conditions and administration.

Chief Facts reported by Inspector: Relatively heavy incidence of enteric fever year by year during period 1897–1904, though no pronounced epidemic. Records available insufficient to enable investigation of its causes. Prominent defects in sanitary conditions and administra-

tion which appear to favour local spread of this disease indicated.

Conditions of housing unsatisfactory; numerous unhealthy conditions in and about dwellings. Leaky house drains and unflushed water closets common. Water service from deep wells, supply intermittent; sewage disposal needs attention; infectious disease prevention and other matters unsatisfactory. Staff and work of sanitary department of Town Council require reorganising. Much greater attention by District Council to public health matters is needed.

1. *SOOTHILL NETHER URBAN DISTRICT (YORKS, WEST RIDING); population (1901), 5,552; Dr. Wheaton. [No. 204, Price 3*d.*]

Authority concerned: Soothill Nether Urban District Council.

Ground of Inquiry: Prevalence of small-pox.

Chief Facts reported by Inspector: Small-pox occurred in 1903, when 15 cases were reported. Disease reappeared in 1904, and up to date of visit on October 4th, 1904, 23 cases had occurred. District contiguous to the Borough of Dewsbury; many inhabitants hostile to vaccination. Owing to failure of Dewsbury and of the Joint Hospital Board to provide small-pox hospital accommodation, patients were retained in their own homes when suffering from small-pox. Administration by the District Council very faulty; no disinfecting apparatus provided; no provision for the temporary accommodation of "contacts" whilst their homes and clothing were disinfected. The Board issued an Order under Sections 130 and 134 of the Public Health Act, 1875, similar to that issued in the case of the Borough of Dewsbury, with the object of facilitating the prompt vaccination and revaccination of the population.

32. *SOOTHILL UPPER URBAN DISTRICT (YORKS, WEST RIDING); population (1901), 6,104; Dr. Wheaton. [No. 204, Price 3*d.*]

Authority concerned: Soothill Upper Urban District Council.

Ground of Inquiry: Prevalence of small-pox.

Chief Facts reported by Inspector: Small-pox prevailed in 1903, when 18 cases occurred, and recurred in September, 1904. At date of visit on October 29th, 1904, 28 cases had occurred. The district is near to the Borough of Dewsbury; some past hostility to vaccination, but less than at Dewsbury; on the occurrence of small-pox vaccination was largely sought

by the inhabitants. Owing to failure of Dewsbury to provide the hospital accommodation which they had promised for small-pox, and the failure of the Joint Hospital Board to provide a small-pox hospital, nearly all the small-pox patients had to remain at their own homes. Administration by the Urban District Council very faulty; no disinfecting apparatus provided, and no accommodation for "contacts" whilst their homes and clothing were disinfected.

33. *THORNHILL URBAN DISTRICT (YORKS, WEST RIDING); population (1901), 10,290; Dr. Wheaton. [No. 204, Price 3*d.*]

Authority concerned: Thornhill Urban District Council.

Ground of Inquiry: Prevalence of small-pox.

Chief Facts reported by Inspector: Small-pox broke out early in May, 1904. Up to September, 1904, 59 cases had occurred. Infection attributed to the adjoining Borough of Dewsbury. District one in which hostility to vaccination was frequently met with. The small-pox hospital was a temporary structure placed in a favourable situation but much overcrowded, without administrative accommodation, disinfecting apparatus or proper laundry. Council had no disinfecting apparatus; disinfection of dwellings unsatisfactory; no accommodation for the reception of "contacts" whilst their dwellings were being disinfected. No medical visiting of "contacts." Not all the cases were removed to hospital. At a second visit on October 13th, the cases totalled 84, the hospital was found to be overcrowded, the provision of a tent having only partially relieved it, owing to female patients refusing to sleep in the tent. Hostility to vaccination greatly diminishing, and large numbers availing themselves of the protection afforded by it.

34. WEST PENRITH RURAL DISTRICT (CORNWALL); population (1901), 11,298; Dr. Spencer Low. [No. 200, Price One Shilling.]

Authority concerned: West Penrith Rural District Council.

Ground of Inquiry: Annual Reports of Medical Officer of Health and other information.

Chief Facts reported by Inspector: Various insanitary conditions in district; dwellings unsatisfactory; local water supplies and sewerage systems need attention. Byelaws required. No isolation hospital accommodation or disinfecting apparatus. Dairies, Cowsheds, and Milkshops Order not enforced.

35. Windsor Rural District (Berks); population (1901), 14,274; Dr. Manby.

Authority concerned: Windsor Rural District Council.

Ground of Inquiry: Complaint by Major Evan Martin on behalf of Princess Christian, as to nuisance from foul ditches in Clewer Green.

Chief Facts reported by Inspector: Ditches found to be badly fouled by slop water from dwellings. Advice given to Rural District Council as to cleansing of cesspools, as to temporary measures for treatment of the foul ditches, and as to providing a system of sewers.

No. 5

REPORT on the SANITARY CIRCUMSTANCES and ADMINISTRATION of the PREESALL-WITH-HACKINSALL URBAN DISTRICT; by Dr. J. Spencer Low.

Since 1900, when Preesall-with-Hackinsall became an urban district, the annual reports of the Medical Officer of Health have shown repeatedly that unhealthy conditions abound there, and that the District Council are making little progress towards securing the amelioration of these conditions. In view of these considerations I was instructed by the Board to visit the district and make inquiry as to its sanitary circumstances and administration. This I did towards the end of May, and ascertained the facts now about to be set forth.

Description of the District.—The Preesall-with-Hackinsall Urban District, situated in the Garstang Union, is bounded on the south and east by the Garstang Rural District (of which it formerly constituted a part), on the north by Morecambe Bay, and on the west by the estuary of the Wyre, on the further side of which lies the town of Fleetwood. The district is nearly flat, with the exception of a low hill at Preesall village and slight eminences at one or two other points. It is dotted with borings for salt through which the brine gains the surface to be piped to various points for subsequent treatment. Most of the houses in the district are said to stand on clay. The following table shows the area and rateable value of the district, together with the population and the number of inhabited houses at each of the last three census periods and in 1903 :—

Area (acres).	Rateable Value for purposes of a General District Rate.	Population.				Inhabited Houses.			
		1881.	1891.	1901.	1903, estimated.	1881.	1891.	1901.	1903.
2,962	£ 8,322	848	896	1,423	1,475	—	185	302	312

The chief industries are agriculture and the various employments connected with salt mining. A number of persons at Knott End, which is a village in the north-west corner of the district, let apartments to visitors. Volunteer camps are frequently established in the district during the summer months.

The length of "secondary" roads to the up-keep of which the County Council contribute is about six miles. The County Council have had occasion to inform the District Council that the grant would have to be withheld unless the roads were better kept. The length of roads repairable by the District Council is about six miles. Their condition in many places was bad when seen by me.

A.—General Sanitary Condition.

(a.) *Dwellings.*—Save for a few thatched cottages the houses at Knott End are for the most part substantially-built brick dwellings. At Preesall village and Preesall Park—the only other parts of the district in which there are aggregations of houses—cottage property of an older type is met with. The rest of the district contains scattered dwellings. The older cottage property is in fair condition; but throughout the district there are many houses with fixed window sashes, and, as a result inadequately ventilated. The Inspector of Nuisances, who had only held office some three weeks at the date of my visit, informed me that he had found houses in process of building with similar defects, in defiance of the building bye-laws in force in the district. The roofs of some of the houses are not watertight. A workroom used by a shoemaker at Preesall village was found to be on the point of collapsing on account of the rottenness of its timbers. One of its walls was some feet out of the perpendicular. A number of improvements in cottage property are said to have been effected in recent years. There is no *overcrowding of dwellings upon area*, many houses having fair-sized gardens, and no *overcrowding of persons in dwellings* came to my notice.

(b.) *Water Supply.*—This is very deficient in quantity and of unsatisfactory quality in all parts of the district. The staple source is rain-water collected from the roofs, and stored in large galvanised iron tanks or in tubs. Supply of water is also obtained from shallow wells and springs. Some wells are in positions which entail risk of their pollution by soakage from adjacent privy pits; while some are said not to be used for drinking purposes unless the rain-water tanks gave out. In summer many of the tanks and wells are wont to fail, with as result serious inconvenience to many persons who are driven to beg water from their more fortunate neighbours or to procure it from sources of supply at distances as great as half a-mile. The inconvenience of this state of things is especially serious in the case of persons who have houses full of summer visitors. In instances where houses have water-closets flushed by hand or by rain-water cisterns, nuisances result from failure of water-supply for flushing purposes. A number of persons complained to me of the quality of the well water, some of which is brackish; while the rain-water from the tanks and barrels contains soot, washings from the roofs, such as bird droppings, and other impurities. Several persons stated that they were unable to drink the water which was available.

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An Inquiry was held in 1903 by one of the Board's Engineering Inspectors into a scheme for supplying water to the district from the works of the Fylde Water Board, but difficulties arose and nothing came of the scheme. In June last a conference was held at Blackpool between representatives of the Fylde Water Board, the Lancaster and Garstang Rural District Councils, and the Preesall Urban District Council, at which an Inspector of the Local Government Board was present. It is as yet too early to predict the result of this conference as the Water Board and the District Councils' views upon certain important legal questions remaining to be settled are divergent. It is hoped, however, that all parties to the conference are fully alive to the necessity for securing an adequate supply of wholesome water for the Urban and Rural Districts concerned, and that technical difficulties may not be allowed to stand in the way of this urgent sanitary requirement. Unfortunately the nearest point to the Preesall District at which the mains of the Fylde Water Board could be tapped is at White Hall, some 4½ miles from the southern boundary of the district and about 6 miles from Preesall village. It is greatly to be hoped that the Council will make every endeavour to obtain for their district an adequate supply of wholesome water, of which the need is urgent.

(c.) *Sewerage.*—The slop water from a portion of the village of Knott End is conveyed to sewers into which a few water-closets also discharge. The outfalls are two in number, one into the estuary of the Wyre, the other to the sands at the northern margin of the district, above ordinary high-water mark. This outfall is unsatisfactory owing to the broad stretches of almost level sands, which do not permit of sufficient fall for the sewage to flow away. It therefore collects in pools, close to the sea front. An outfall to these sands can hardly be made satisfactory owing to this lack of fall. In Preesall village I saw a number of choked gullies. This village has sewers for slop-water, discharging into ditches, in some places close to houses. A few water-closets discharge to cesspools or into these sewers. The ditches, on account of the level nature of the land, remain partially filled with stagnant water and evil-smelling sludge. Similar slop-containing ditches are found in numerous parts of the district, even at Knott End. During the week or two previous to my visit, the Inspector of Nuisances had occasion to break into two sewers. One of these behind Elletson's Terrace, Preesall, some 300 to 400 feet in length, was found to consist of 6-inch stoneware pipes, with clay joints and a mean fall of 1 in 300; for the last 150 feet the fall was found to be in the reverse direction to the flow, and the tops of the pipes were for some distance not 2 inches below the surface level of the back road along which the sewer is laid. At points the sewer was standing ⅞ths full partly because it had been laid in a "switch-back" manner. The outfall was to a leaking cesspool without a proper cover. In another sewer behind Clarence Street, Knott End, the junctions for branch drains had been formed by knocking holes in the sewer pipe, the "joints" being composed of a brick plastered round with clay. These "joints" were found to be leaking freely. A pump from a well supplying water which is used for drinking purposes, is situated

on the line of this sewer. These two examples of sewering, which have come to light within the last week or two tend to suggestion that the condition of the sewers in the district is far from satisfactory. At Knott End there is a very rudimentary "septic tank" and filter-bed installation which has been erected by a private owner to deal with the drainage of some 20 houses. When seen by me, the tank and filter-beds were choked with sludge, and the ditch to which the effluent discharged was in a similar condition. The filter-beds form a series of open cesspools and constitute a serious nuisance.

The Urban Council have had under consideration the question of sewerage in their district, but without definite result. It is, nevertheless, clear that conditions of drainage, sewerage, and sewage disposal in the more populous parts of the district stand in urgent need of improvement, and this matter should receive the serious attention of the Council.

(d.) *Disposal and removal of excrement.*—There are not many water-closets in the district; some drain to sewers which discharge into ditches or into the sea, others into cesspools. Some water-closets have unventilated soil-pipes, while in one instance that came under my notice, the only means of ventilation of the soil-pipe consisted of some two feet of 1-inch lead-piping opening beneath a bedroom window.

Privy middens, cesspits, and pail closets are the commonest modes of excrement disposal. Many of the privy middens were full and smelt offensively. Some privy pits were mere holes in the ground, unlined and uncovered. The covered brick privy middens, many with a capacity of over 60 cubic feet, have to be emptied by the scavenger entering the opening through which ashes and other refuse are thrown, and while standing in the filth he has to shovel it out through the window opening. Privy middens of this type, and of a holding capacity considerably in excess of that permitted in the building bye-laws in force in the district, are at present being erected in connection with new houses. Pails are not infrequently leaky, being indeed old household pails or wooden tubs in a dilapidated condition.

The Council empties the middens and pail closets of those householders who will not empty their own. They approve of large receptacles on account of the less frequent need of removal of their contents. This removal is effected by an ordinary farmer's cart which during the process allows fouling of the streets and lanes by liquid and semi-liquid filth. Some householders dispose of their privy contents upon their gardens. Cesspools are said to be emptied by the Council's employés when the householders demand it, but the new Inspector of Nuisances has the matter under consideration and a more satisfactory and regular system may be inaugurated.

(e.) *Disposal and removal of refuse.*—Refuse is disposed of in privy middens, ash tubs, or on gardens. It is removed by the Council in Knott End and elsewhere at irregular intervals.

(f.) There are no *common lodging houses*, "*tenement*" *lodging houses* or *offensive trades* in the district.

(g.) *The slaughter houses* are registered and are two in number. Structurally both are in a satisfactory condition. The surroundings of one, however, were filthy in the extreme, blood being permitted to run along an earth channel to an overflowing tank adjoining a large dungheap, close to the slaughter-house. Entrails are said to be buried in this dungheap, but fresh entrails as well as others were to be seen scattered about. The stench from this dunghill was very offensive. A proper receptacle and a drain to convey off the blood and washings from the slaughter house should be provided. The position of the dunghill should be moved much further away from the slaughter house.

(h.) The number of *cowhouses* is not known. There are said to be no *dairies* or *milkshops* in the district. The *Diaries, Cowsheds, and Milkshops Order* is disregarded. I visited a number of cowsheds and found them exceedingly dirty, ill-kept, badly lighted, inadequately ventilated, and judging from the number of stalls available, grossly overcrowded, the air space in some sheds not exceeding 200 cubic feet per stall. They do not appear to have been inspected in the past with any result, and the subject is one to which the new Inspector of Nuisances must needs devote considerable attention.

(i.) There are eight *bakehouses* in the district. All are registered. None of them are underground, and those I saw were well kept.

B.—Sanitary Administration.

Preesall-with-Hackinsall, previously part of the Garstang Rural District, was in 1899 constituted an Urban District by an Order of the County Council of Lancaster. No petition having been presented to the Board to disallow the Order of the County Council, the Board in March, 1900, issued a Confirmation Order in pursuance of the provisions of sub-section 4 of section 57 of the Local Government Act, 1888. In favour of the formation of this small Urban District it was stated that the part of the Garstang Rural District in question suffered from lack of sanitary supervision, that it had no proper water-supply, and that it was without a sewerage system; while it was claimed that its constitution as an Urban District would facilitate improvement of these unsatisfactory conditions.

It is now more than four years since Preesall-with-Hackinsall was constituted an Urban District; and there is no evidence that material progress has been made towards the improvement in the sanitary circumstances so hopefully foreshadowed in 1899. It is indeed difficult to conceive that the conditions of the district, regarded from a sanitary standpoint, can have been appreciably worse at that time than they are to-day. The water-supply, unwholesome in quality and of insufficient quantity; the faulty

conditions of sewerage, drainage and disposal of sewage; the serious nuisances, many of them in relation with unsatisfactory disposal and removal of excrement and refuse, in the near neighbourhood of the great majority of dwellings; the neglected state of cowsheds; the entire absence of provision for the isolation of cases of infectious disease other than small-pox and of any trustworthy means of disinfection; the numerous infringements of the bye-laws in force in the district—all bear testimony to the failure of the Urban District Council to perform the duties which have been entrusted to them as guardians of the public health.

The *Bye-laws* in force in the district are as follows :—

Offensive Trades; allowed by the Board on May 7th, 1901.

Slaughter-houses; allowed by the Board on May 7th, 1901.

Common Lodging-houses; allowed by the Board on June 6th, 1901.

Nuisances; allowed by the Board on July 23rd, 1901.

New Streets and Buildings; allowed by the Board on March 22nd, 1902.

The Public Health Acts Amendment Act, 1890, was adopted on July 22nd, 1901.

The *Medical Officer of Health*, Mr. W. H. Robinson, M.R.C.S., L.R.C.P., receives an annual salary of £20, half of which is repaid by the County Council. He is also Medical Officer of Health for the Fleetwood Urban District, and for the Fleetwood Port Sanitary District. He has pointed out the shortcomings of the district year by year in his annual reports and has urged the Council to deal with them, but apparently little notice has been taken of his advice.

The *Inspector of Nuisances.*—Mr. E. Whitwell was appointed in April, 1904, and as has been said, had held office only some three weeks at the date of my visit. He receives an annual salary of £30, half of which is repaid by the County Council, with £20 per annum as District Surveyor. He is also in private practice as Surveyor. He holds the certificate of the Sanitary Institute and other certificates for subjects allied to his work. He appears to be a capable, intelligent, and active officer, who with the support of the District Council should make an efficient Inspector of Nuisances. The nuisances and other unhealthy conditions that abound in the district call for much sustained work from this officer in his capacity as Inspector of Nuisances. With a view to the discovery and removal of these conditions, a house-to-house inspection of the district, followed by frequent after-visits is necessary.

Isolation Hospital.—No arrangements have been made for the isolation of infectious diseases except in the case of small-pox, which would be isolated in the hospital of the Garstang, Fylde and Preston Joint Small-pox Hospital Board, at Elswick, which is some seven miles from Preesall village, and about eight miles from Knott End.

The following table shews year by year the number of notified cases of scarlet fever, diphtheria and typhoid fever in the district since its formation :—

——	1900.	1901.	1902.	1903.
Scarlet fever	25	13	18	8
Diphtheria	1	3	5	4
Typhoid fever	1	1	2	Nil.

In commenting on the subject of isolation accommodation, the Medical Officer of Health has observed in his annual reports that there are grounds for believing that if the cases of scarlet fever could have been properly isolated there would not have been so many of them. In 1902 four cases of scarlet fever occurred in one house, three in another, and two cases in each of two houses. The District Council should make arrangements whereby they may have at their disposal hospital accommodation for infectious diseases other than small-pox.

There is no *disinfecting apparatus*. Houses are disinfected by fumigation with sulphur. Infected clothing, bedding, &c., are not further disinfected under the supervision of the Council's officers. Izal is supplied to infected households. The provision of a steam disinfector, not necessarily of an expensive type, is very desirable with a view to securing efficient disinfection of infected articles and the consequent limitation of the spread of epidemic disease.

I have much pleasure in acknowledging the assistance I received from the officers of the Council in my inspection of the district.

RECOMMENDATIONS.

1. The first and most urgent need for the district is the provision of an adequate supply of wholesome water.
2. The faulty conditions of drainage, sewerage, and sewage disposal should be remedied.
3. A house-to-house visit of the whole district should be made, and the innumerable nuisances at present existing should be suitably dealt with.

4. Systematic removal of excrement and refuse, and the emptying of cesspools at suitable intervals, should be arranged for where necessary.

5. The cowhouses should be registered and regularly inspected, and the other provisions of the Dairies, Cowsheds, and Milkshops Order should be enforced.

6. Arrangements should be made, preferably in combination with a neighbouring Authority, for the provision of efficient means for isolating cases of infectious diseases other than small-pox, and for the provision of a steam disinfector.

7. The existing bye-laws should be strictly enforced.

No. 6.

APP. A, No. 6.

Sanitary Circumstances and Administration of, and Enteric Fever in, Sheerness; by Dr. Buchanan.

REPORT on the SANITARY CIRCUMSTANCES and ADMINISTRATION of, and as to PREVALENCE of ENTERIC FEVER in, the URBAN DISTRICT of SHEERNESS; by Dr. G. S. BUCHANAN.

The inquiries to which this report relates were made as opportunity afforded at various dates in December, 1904, and January, 1905. Their object was to obtain information regarding the sanitary circumstances associated with the incidence of enteric fever on the Urban District of Sheerness during 1904 and in several antecedent years, to which the Board's attention had been drawn by the returns of the Registrar-General and by annual reports of the Medical Officer of Health of the district. I would record my indebtedness, for assistance in my inquiries, to the officers of the District Council (in particular Mr. V. H. Stallon, the Clerk, and Dr. Arrol, the Medical Officer of Health) and to Mr. J. Copland, Chairman of the Council. Following a communication which the Board addressed to the Lords of the Admiralty, the Commander-in-Chief at the Nore was good enough to place information at my disposal concerning the Royal Dockyard and Naval Garrison.

This report is divided as follows:—

Part I.—Enteric Fever in Sheerness, 1897–1904.

„ II.—Sanitary Circumstances and Administration of Sheerness.

„ III.—General Observations and Recommendations.

Addenda:—

1. Attack Rates from Enteric Fever in certain towns in England and Wales;
2. Notes on calculation of Death Rates in Sheerness;
3. Well Sections and Water Analyses.

PART I.—ENTERIC FEVER IN SHEERNESS, 1897–1904.

Table I. shows the number of cases of enteric fever which have been notified since 1897, respectively in the whole Urban District, in each of the three sub-divisions of the town of Sheerness, Blue Town, Mile Town, and Marine Town, and in the hamlet of West Minster, nearly a mile south of Blue Town, which is also included in Sheerness Urban District.

TABLE I.—NOTIFIED CASES OF ENTERIC FEVER IN SHEERNESS URBAN DISTRICT.

[Exclusive of cases notified from Naval and Military Hospitals.]

—	Blue Town.	West Minster.	Mile Town.	Marine Town.	Whole Urban District, exclusive of Naval and Military Garrisons.	Annual Attack Rate per 1,000 from Enteric Fever (on 1901 population).
Population, 1901	2,565*		7,295*	4,325*	14,293	
1897	1	5	18	4	28	1·96
1898	14	—	5	14	33	2·31
1899	3	1	5	5	14	0·98
1900	15	5	13	7	40	2·79
1901	6	2	15	2	25	1·75
1902	—	—	11	8	19	1·33
1903	6	—	7	2	15	1·05
1904	5	—	8	4	17	1·19

* Figures furnished by Clerk to District Council.

The population of the naval and military garrisons stationed at Sheerness fluctuates considerably, but may be thought of as:—naval (including gunnery school) about or over 1,000; military (including women and children in military quarters) about 800. There is also a variable and often large population on ships of the Royal Navy afloat in the Medway off Sheerness. Among these several populations cases of enteric fever occur from time to time—for example, in the two years 1903–4, five cases of this disease were admitted to the Sheerness Naval Hospital and three to the Military Hospital. But as it would be a matter of considerable difficulty to obtain a complete return of such cases for a series of years or to ascertain with certainty whether in each instance infection had probably been contracted in Sheerness, I have omitted all such cases from Table I.

In Addendum 1 are given the annual attack rates from enteric fever during seven years, 1898–1904, in 90 towns in England and Wales. For all these towns together the annual attack rate per 1,000 during this period was 0·96. For Sheerness Urban District the corresponding figure was 1·63.

Table II. shows the number of deaths from enteric fever recorded in Sheerness from 1897 to 1904 inclusive, and the mean

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death-rate from this disease during the eight years in question per 1,000 of population.

TABLE II.—DEATHS FROM ENTERIC FEVER IN SHEERNESS URBAN DISTRICT.

[So far as ascertained, none of these deaths occurred in Naval or Military Hospitals.]

Year.	Enteric Fever Deaths.	Year.	Enteric Fever Deaths.	Annual Death Rate from Enteric Fever per 1,000 of Population.	
1897	6	1901	3	Sheerness, U.D., 1897–1904 (on 1901 population) ...	0·279
1898	3	1902	3	England and Wales, 1898–1902 (from Registrar-General's Annual Report, 1903)—	
1899	3	1903	5	"Urban Counties" ...	0·193
1900	5	1904	4	"Rural Counties" ...	0·104

It will be seen from the above figures that although Sheerness has not suffered from a pronounced epidemic of enteric fever during any of the years under review, the incidence of the disease upon this district year by year since 1897 has been relatively severe, and needs explanation. Inquiry as to the cause or causes of epidemic enteric fever in a given locality, at all times a matter of much difficulty, demands, however, in every case a study of recorded facts as to the circumstances associated with the attack of individual sufferers by the fever: for example, observations made at the time regarding their relations with antecedent cases; condition of invaded dwellings; drinking water; origin of milk, shellfish, or other articles of food liable to convey enteric fever infection. In Sheerness few such observations have been made: none have been recorded. Hence I am unable to do more than indicate, as a result of inquiries and inspection in various parts of Sheerness, and particularly at dwellings where cases of enteric fever had occurred during 1903 and 1904, certain prominent defects in sanitary conditions and shortcomings in sanitary administration which appear to favour local spread of the disease. These will be gathered from Part II.

PART II.—SANITARY CIRCUMSTANCES AND ADMINISTRATION OF SHEERNESS.

Topography, &c.—The Urban District of Sheerness (area 838 acres) occupies the north-west corner of the Isle of Sheppey. In shape it is roughly a triangle, its west side the mouth of the Medway, its north side the sea which fills the estuary of the Thames, and its south-east side the boundary between Sheerness Urban District and Sheppey Rural District. The north-western

angle of this triangle is sharply cut off by a strip of open space and by the Town Moat: it contains the Royal Dockyard, the naval and military barracks and forts (including Garrison Point Fort) and "Blue Town," the oldest part of Sheerness, which consists of houses closely packed together on land south of the Dockyard wall. Across the Town Moat, to the east, is the main part of Sheerness, "Mile Town," continued further to the east by "Marine Town," which faces the sea. The rest of the triangle is open country, some of which is under Government control, and is unbuilt upon save at West Minster, a hamlet facing the Medway at the south-western angle of the triangle.

The whole of the district is flat, and below high-water level. It depends upon the height and stability of its sea walls for protection against flooding. A serious flood took place in November 1897, when all the streets were under water. A small flood, the effect of which was limited to parts of Blue Town, occurred at the end of last December. The greater part of the sea walls is maintained at Government expense, and large sums were spent on their improvement after 1897.

Sheerness rests upon a considerable thickness of alluvial deposit which has been formed at the mouth of the Medway. In the dockyard and in Blue Town this alluvium is a bluish mud, so soft that the docks and more substantial buildings have had to be built on piles. In Mile Town and Marine Town the alluvial deposit is generally more firm, and in places is overlaid by a layer of broken shells such as is seen at Shellness, at the eastern end of the Isle of Sheppey. A considerable part of the subsoil is drained to ditches on the outskirts of the town,* but speaking generally rainwater does not readily soak away, and tends to hang about the surface of the ground.

Occupation of Inhabitants.—Sheerness exists by reason of the Royal Dockyard, at which the bulk of its adult male population is employed. The Dockyard became of considerable importance early in the last century, about which time a large part of Mile Town was built. Marine Town is of later date. In recent years the Dockyard has been utilised mainly for works of repair, especially to cruisers and destroyers. Twenty years ago the total strength of the dockyard was about 2,000; in the middle of January, 1905 it was 3,069, of whom 1,125 were employed in the Chief Constructor's department and 1,180 in the Chief Engineer's department. Many of the workers belong to families which have lived in Sheerness and have been employed in the Dockyard for two or three generations. Men of the working-class in Sheerness possess in somewhat exceptional degree the advantage of regular employment; large and sudden reductions in the Dockyard staff have seldom occurred. Including officers on salary, there were in January of this year 707 men "on the establishment," the workmen receiving a slightly reduced weekly wage in return for

* Extensive works of land drainage were undertaken in the Isle of Sheppey in the sixties and seventies. Before these drainage works malaria was extremely prevalent in the island, including Sheerness itself. (*Cf.* Annual Report of the Medical Officer of the Privy Council for 1869, p. 35.) Malaria for many years has practically disappeared from the island.

permanent engagement and title to pension. Many of those not on the establishment, however, have worked regularly in the yard for many years; there is a system of gratuities in respect of long and continuous service among them. The number of persons employed in the Dockyard is from time to time augmented when special work is being carried out by contractors, whose workmen are not included in the total strength. The bulk of the men employed at the Dockyard receive from 24*s.* to 36*s.* a week. A strict medical examination is made of all men before admission to the establishment: the fitness of those not on the establishment is also ascertained by medical examination before they are taken into employ.

There are no important industries or factories in Sheerness, and it has little sea or river traffic apart from the Royal Navy. The inhabitants have established several large co-operative societies for food supply, medical attendance, house purchasing, and other objects. Rooms are let to visitors in the summer months, particularly in Marine Town.

Population: *General Death Rate.*—At the Census of 1901 the population of Sheerness (excluding floating population, 2,206; naval and military garrisons, 1,680) was 14,293. At the Census of 1891 and 1881, after similar deductions, it was 12,549 and 12,533 respectively. In annual reports of the Medical Officer of Health of Sheerness it has been the custom, when estimating the population on which the annual death-rate of the Urban District is calculated, to include the persons afloat and in the naval and military garrisons at the date of last Census. The series of death-rates thus obtained are abnormally low, and from this circumstance it is apt to be erroneously inferred that Sheerness is a remarkably healthy place of residence. Some memoranda with regard to the general death-rate of Sheerness, which may be useful for future reference, will be found in Addendum 2 to this report.

Housing.—Owing to its position with regard to the sea and Medway, to the marshy character of the land on the south and east, and to military and naval requirements, the inhabited area of Sheerness Urban District is small and sharply circumscribed. Blue Town is a collection of about 500 small dwellings, packed in an irregular manner on about 16 acres of land. The dwellings of Mile Town and Marine Town, together about 2,500, stand upon about 150 acres. The southern part of Mile Town and eastern end of Marine Town contain the larger and more recently built dwellings in the place. New houses within the Urban District are in demand; about a hundred such houses have been built during the past four years, and the number would doubtless have been larger if a greater extent of land had been available for building. Recently a considerable number of new houses have been put up just outside Sheerness in the Sheppey Rural District.

Most Sheerness dwellings are small, and their rooms are small likewise. The 1901 Census return shows 2,999 inhabited houses and a total of 3,367 "tenements" in the Urban District; of the

latter, 1,334 tenements contained less than five rooms—a larger proportion than in any other urban district or borough in Kent. Four hundred and twenty-eight tenements consisted of one or two rooms only, a proportion (relative to total tenements of less than five rooms) also higher than that of any urban district or borough in Kent with the exception of Penge. These small tenements are sometimes considerably overcrowded; evidence of this will be seen from Census returns of the number of persons occupying tenements of one or another class.

Rents in Sheerness, relatively to the character and extent of accommodation provided, are often high. There are many landlords who own but a small number of dwellings, and also a few who own a considerable amount of smaller house property. Newer dwellings are in a great many cases owned by their occupiers, who purchase them by the aid of a building society.

Structure and General Condition of Dwellings and their Surroundings.—In former years timber from the Dockyard was easy to come by. Nearly all the dwellings in Blue Town, and many of those in the central part of Mile Town, are built of wood. Elsewhere the houses are of brick, sometimes faced with cement. Many of the wooden houses are of substantial construction, and have been kept in tolerable repair inside and out. But in a large number of cases a variety of dilapidations exists. I saw many instances of leaky roofs, broken floor boards and stairways, rotten timber at the foot of the walls, broken window frames, and dampness of interiors. Dilapidations of this sort are not restricted to Blue Town or to wooden houses; they are to be found, though less abundantly, in other parts of Sheerness and in brick dwellings. Wetness of walls and foundations is often present and is sometimes intensified by absence of, or defects in, eaves gutters and down spouting: the walls of most of the brick houses in the town have been built without damp proof courses. Tenants of dilapidated houses are often afraid to make representations to their landlord, or to the agent to whom their rent is paid, lest they should receive notice to quit and find themselves without anywhere to go. "If you cannot put up with it, others can," seems to be an argument frequently employed in such cases.

A large proportion of the wooden houses, and also some brick dwellings, have no windows at the back, and no means of through ventilation. Some houses have living-rooms below the ground level, which are dark and damp.

In Blue Town and parts of Mile Town the smaller dwellings are reached by narrow passages or footways opening out of the main streets. Many of these passages have been flagged or paved in recent years by the District Council. The yards and approaches to the houses themselves, however, are often badly paved and channelled, or not paved at all; accumulation of slop water and rain water on the uneven surface of these yards is an objectionable characteristic of many Sheerness premises.

House drains are said to be often badly laid, and jointed only with clay. Fortunately the sewers are so placed that it has seldom been necessary to carry the house drain beneath the dwelling. The house drain usually receives slop water, rain, and surface water from a gully or gullies in the yard, and also the discharge from the water-closet drain. These yard gullies frequently become blocked and give rise to nuisance. To a large extent this is brought about by the unsatisfactory paving and channelling of the yards. A few of the gullies which I saw were provided with bell-traps; most of them, however, are trapped gullies of earthenware.

Nearly all the dwellings are provided with water-closets; in a few instances two or three houses have a single closet in common. Water-closets are usually placed at the end of an outbuilding which contains the kitchen or scullery; in the older property they are generally separate from the dwelling altogether. In the larger and newer houses soil-pipe ventilators are provided; these, however, are as a rule unsatisfactory for the purpose, being narrow in bore and having various sharp bends in their course.

The majority of water-closets in Sheerness have no flushing apparatus. The condition of closet pans in such cases depends upon the frequency with which they are washed down by hand, and this in turn depends to a large extent on the position of the nearest tap or of the tub or other vessel used to store water during intermission of supply. In the circumstances it was satisfactory to find that the majority of closet pans which I saw were tolerably clean; many, however, were in a filthy condition, while in some the soil pipe or trap was choked and the pan was full to overflowing. In the larger dwellings and in most houses of recent construction siphon tanks or other means of flushing the water-closets are provided. In some instances water for flushing is obtained by means of pipe and tap from a cistern also used to supply drinking water; in one case I found the town water piped direct to the closet pan. As the water supply is intermittent such an arrangement is dangerous, on account of the risk of in-suction.

In the smaller and older properties water is, as a rule, obtained from standpipes, which often supply several houses in common; where water is laid on to the dwelling, the tap is frequently placed over disused "coppers" and undrained slop sinks, or in other awkward places. The course of the water pipe from the public main to the house or standpipe is usually unknown; it is stated that these pipes frequently lie alongside the house drains, but on this point I was unable to obtain any direct evidence. Comparatively few houses have cisterns (other than flushing tanks for closets). The need for storing water in consequence of intermissions of supply is generally met by placing tubs, buckets, or tanks beneath the standpipes in the yard or the taps in the dwelling. Taps are seldom completely turned off, and water, whilst it is available, is habitually wasted.

Dwellings constructed in recent years are for the most part small brick houses of the usual type. Damp-proof courses are

provided, but the sites of these dwellings are seldom covered with concrete. The area of open space exclusively belonging to the dwelling is often undesirably small. Water-closets of these newer dwellings as a rule, but not invariably, are provided with means of flushing. House drains are said to be laid in a more satisfactory manner than was formerly the case. As, however, it is not the custom for house drains of new dwellings to be tested by the sanitary authority, I have no direct evidence on this matter. The construction of new streets and buildings in Sheerness is nominally regulated by a series of byelaws made by the Sheerness Local Board of Health in 1868.

In illustration of certain of the objectionable conditions observed in connection with dwellings, I extract the following from notes made during my inspection :—

Albion Square, Mile Town, No. 31.—Brick house of four rooms. No through ventilation of upper rooms; no windows at back. Walls damp. Woodwork dilapidated. Down spout too short. Yard recently partly paved, but draining imperfectly to gully. Water tap in cellar, water running; no drain or other provision for overflow. Cellar reached by steps from yard; water at foot of steps. Closet in yard; no flushing apparatus. Water has to be fetched to it from the tap in the cellar. Rent 6*s.* 9*d.* a week. Seven in family. Two cases of enteric fever 1904. Next door gully blocked, slop water overflowing the yard. Neighbouring houses (Albion Square and Albion Place) of similar character.

Hope Street, Mile Town.—General bad state of yards. Two houses invaded by enteric fever in 1904. A few of the houses without eaves gutters or down spouts.

Wood Street, Mile Town, No. 13.—Badly-paved yard. Water-closet without flushing apparatus. Old drain common to several closets said to pass beside or beneath the house. Two cases of enteric fever, January 8th and March 21st, 1903. Drains not examined or tested by sanitary authority in that year or since.

Blyth's Court, Blue Town, Nos. 1, 2, and 3.—Dilapidated wooden walls; in places seem likely to fall out. No through ventilation. Floors broken. Downstairs room of No. 1 uninhabitable on account of damp. Three occupied rooms in this house; six occupiers. Closet pan choked and full up to seat; no flushing apparatus. Yard uneven.

Fountain Passage (back of Union Street), Blue Town.—Wooden houses. Roofs leaky. Very uneven yards; no flushing apparatus to closets; blocked yard gully.

West Passage, Blue Town, No. 6.—Small wooden house, four rooms. No eaves gutters; foundations damp; window frames broken. Closet at back without flushing apparatus and very dirty; water tap is on the other side of the house, far away from the closet. Surface of yard broken.

Edward Street Passage, Blue Town. Nos. 2, 2A and 3.—Wooden houses; walls dilapidated; damp inside. Floors broken. Roofs leaky. Window frames defective; some windows will not open. No through ventilation. Yards badly paved. Closets unflushed and in filthy condition. Similar conditions in neighbouring houses. No. 3 contains ten rooms inhabited by three families, paying rent respectively 4*s.*, 4*s.*, and 3*s.* 3*d.* a week.

East Lane, Blue Town, "Harry's Buildings."—Two-storey brick houses erected 1901. Extent of yard exclusively belonging to each dwelling only 11 feet by 5 feet—permitted by District Council notwithstanding transgression of byelaws. No flushing apparatus to closets.

Allen Square, Blue Town.—Brick houses, three rooms, one above the other; no through ventilation. Foundations damp; spouting defective.

Bethel Passage, Blue Town, Nos. 10 and 11.—Two brick houses built about four years ago. Each house has two rooms, one above the other. No openings in back wall. Yard space of each 11 feet by 6 feet, transgressing byelaws.

Alma Street, Marine Town.—Medium-sized dwellings, built about 30 to 40 years ago. No. 23.—Water-closet flushed from cistern which supplies drinking water. Soil pipe of water-closet unventilated. Old rain-water tank in yard has been connected underground with public supply. No. 81.—Water-closet similarly flushed. Soil pipe ventilated, but inadequately. No. 71.—Water-closet flushed by a pipe controlled by screw tap, leading direct from the main to the closet pan. No. 57.—No flushing apparatus. Enteric fever case or cases in this street in 1902, 1903, 1904, and January, 1905.

New Streets, Marine and Mile Towns.—Sites of dwellings not concreted. Ventilating pipes each serving closets of two dwellings, usually two inches or other insufficient bore, needlessly long and with several right-angle bends. Drains not tested before houses taken into occupation or since. No. 20 of the Sheerness Building Byelaws specifies that drains "of all houses should be laid with water-tight joints," and No. 26 that "no new house shall be occupied until . . . certified after examination to be in every respect fit for human habitation.

Water Supply.—Sheerness obtains its water from the District Council's waterworks in Mile Town, at which are two deep wells. The dockyard and the various naval and military establishments are supplied, independently of the town, by means of separate wells, pumps, and mains, belonging respectively to the Admiralty and War Department. Connections have been made, however, between the several systems of mains, and on occasion the naval or military water supply is supplemented from the town wells, or *vice versâ*.

The following particulars have been supplied to me regarding these deep wells :—

Well.	Depth of bottom of well from surface (feet).	Depth of bottom of bore pipe from surface (feet).	Approximate number of hours pumped on week-days.	Approximate quantity pumped per week-day (gallons).
Town—				
"Old Well" (1863)... ...	293‡	376	7 to 12 (summer average, about 10).	130,000 to 230,000 (summer average,* 205,000).
"New Well" (1878) ...	302‡	805		
Admiralty—				
"Navy Well" (? 1780) ...	over 300‖	—	12½	35,000
"New Dockyard Well" (1864) (bore deepened 1894).	330	568†	12½	38,000
War Department—				
"Garrison Well"	200	800	4 to 5 (longer in summer).	14,000 to 16,000

* Average calculated from daily figures for June, July, and August, 1902, 1903, and 1904, and includes Sundays.

† Bore driven in 1894 to 960 feet below surface, but bore tube has since been drawn and lower end plugged.

‡ Depth from engine room floor.

‖ 22 feet of sand in lower part of well.

Water pumped from the town "old" well and from "navy well" is derived from tertiary strata between London Clay and Chalk (Oldhaven beds, thickness about 14 feet; Woolwich beds, about 52 feet; Thanet sand, about 94 feet; total thickness about 160 feet). In Addendum 3 I have noted some of the recorded well sections.

At Sheerness there are about 80 feet of alluvium, below which are some 270 feet of London clay. The Oldhaven beds are reached about 350 feet, and the chalk about 510 feet, below the surface. To what extent the town "new" well, or the other wells with deeper boreholes, besides drawing from the chalk, obtain water from the tertiary strata above, I am unable to say. The few analyses of Sheerness well waters which I have been able to collect are given in Addendum 3. The water is soft and slightly alkaline. It is liable to contain sandy and other mineral matter in fine suspension. This suspended matter has given rise to trouble in the pumps and to accumulation of deposit in cisterns and dead ends of mains.

The upper parts of both town wells are lined by cast-iron cylinders for the exclusion of surface water. Most of the town supply is got from the new well. The surveyor informed me that the pump of the old well is used only in emergency. New and old wells are connected together by a tunnel about 200 feet below the surface. When the pump of the new well is started in the morning, water is drawn from both wells until the water level has fallen below that of the tunnel, after which only the new well is drawn upon. The water is pumped to a water tower at the waterworks containing a service tank of about 114,000 gallons working capacity. Pumping goes on for about 7 hours to 12 hours a day according to requirements. Every afternoon water is turned off in one section of the town after another, the supply in certain sections being usually shut off by 3 p.m. or earlier. When the supply of the whole town has been turned off pumping is continued until the service tank has been filled ready for the following morning. The daily amount pumped is largest in summer. During June, July, and August of 1902, 1903, and 1904 respectively the average supply was 209,000, 206,000, and 201,000 gallons a day. The mean, 205,000 gallons a day, represents 13·7 gallons per head on a population of 15,000. In dry seasons it has been necessary to pump sometimes as much as 12 hours to obtain a daily supply of 205,000 gallons; at such seasons the daily yield would probably not be greatly increased if, with the present plant, the pumping were carried on continuously.

A loan of £10,900 for waterworks purposes was sanctioned by the Board in 1894, and most of this sum has been spent during the past 10 years in laying or relaying mains and in providing new hydrants. The old mains in many instances were found nearly choked. There are numerous "dead ends" which in all cases are carried above the surface of the ground. These dead ends are flushed out at intervals of one or more months.

The objections to the system of intermittent supply in Sheerness have been indicated above in connection with housing. (1) Very few dwellings have any proper arrangements to store water. Inability to obtain water from taps or standpipes between afternoon and early morning gives rise to diverse inconvenience. Moreover, the methods in vogue when water is not to be had from the tap—dipping all kinds of vessels into tubs or pails which themselves are left exposed to dust and other sources of contamination—cannot be free from risk where drinking water is concerned. (2) As most of the water-closets have no flushing tanks, absence of water for more than half the 24 hours is specially objectionable. (3) Risks of dangerous insuction arise, *e.g.*, where leaks occur in domestic service pipes laid in soil polluted by sewage or slop water. Each of the above defects of the public water service is lable to conduce to enteric fever prevalence in Sheerness.

There are very few fixed baths in Sheerness dwellings; trade demands for water are relatively unimportant. The quantity used for a day's street watering is usually 16,000 gallons; exceptionally it is as much as 24,000 gallons. Sea water is used to flush the sewers. As already indicated, great waste of water often occurs under present conditions. In view of these and other considerations it seems probable that if a continuous supply of water were provided along with proper arrangements for waste prevention, the daily quantity of water necessary would not greatly exceed that which is now supplied on the intermittent system.

Sewerage and Sewage Disposal.—The town was provided with a system of sewers in, or soon after, 1860. Important additions were made in 1877 and 1893; in the latter year new main sewers for Mile Town and Marine Town were constructed. Defects are from time to time observed in the older sewers; insufficient or irregular fall, leakage between drainpipes originally jointed with clay, repairs in which pipes of wrong size have been used, and the like. In several of the worst instances the District Council has within recent years substituted new sewers. In Sheerness the sewers receive street washings as well as drainage from houses and yards. I have no data on which to reckon the dry weather flow. Several flushing pipes were provided in 1898 through which sea water can be admitted into the sewers at high tide.

The main sewers from Blue, Mile, and Marine Towns join a single outfall sewer, which conveys the whole of the town sewage by gravitation to tanks at West Minster. These tanks are said to have a total capacity of about 150,000 gallons. They were seriously damaged by the big tide of 1897, and have not been since repaired. They are emptied by a pipe into the Medway at a point stated to be about 500 yards from the shore, the outfall being below ordinary low water level and uncovered only during spring tides. Sewage can be discharged from the tanks by gravitation when the Medway is at or below half-tide level; usually this discharge takes place on the ebb. It is often necessary to supplement this arrangement by pumping. At high water sewage is practically stagnant throughout the whole of the Sheerness sewers; and if the tanks at

West Minster have become completely filled, sewage is dammed back to such an extent that in Blue Town it nearly reaches the manhole covers. Pumping is thus the only safeguard against the overflow of sewage in Sheerness which would be caused by the coincidence of high tide and heavy rainfall. The pump in use is a Gwynne's 10-inch centrifugal pump which was brought to the tanks as a temporary expedient after the damage done by the flood of 1897. It is said to be capable of lifting 30,000 gallons an hour. On several occasions overflow from the town sewers has only just been avoided by energetic pumping.

The Dockyard, naval, and some of the military establishments are sewered independently of the town. The bulk of the Dockyard sewage (including that from most of the workmen's latrines), together with a portion of the sewage from the military barracks, is received into sewers on the Shone system, leading to a 6-inch cast-iron outfall sewer, which enters the Thames estuary 700 yards east of Garrison Point, and is carried out 1,400 feet from the sea wall. The outfall is said to be submerged at all states of the tide. The daily quantity discharged is estimated by Fleet Surgeon McKinley as 26,000 gallons. Sewers from the Gunnery School, from certain latrines in the Dockyard, and from the Military Hospital are carried directly into the Medway to the south of Garrison Point; one of these direct outfalls is into Rats Bay, a narrow strip of water and foreshore which lies between the wall of the Dockyard and the town pier.

It will be observed that the whole of the Sheerness sewage is discharged into the Medway or Thames estuary in a crude state. In this connection questions have arisen as to (*a*) creation of nuisance by pollution of foreshores; (*b*) pollution of oysters and other shellfish.

With regard to (*a*), the Medway foreshore in question is known as the Lappel, and extends from Sheerness Dockyard and Rats Bay up to and beyond West Minster. A broad stretch of this foreshore, covered by mud, is exposed at low tide. On occasion—*e.g.*, in hot weather, or after certain conditions of tide and wind—an offensive smell arises from this mud. This nuisance is apparently related, in greater or less degree, to discharges of sewage from the West Minster outfall (and from the separate small outfalls from Gunnery School, Military Hospital, &c.), to sewage pollution of the Medway in its higher reaches, and possibly also to the numerous vessels of the Royal Navy anchored in the Medway off Sheerness.

There are no dwellings behind the Lappel, and when the foreshore smells offensively the persons affected would mainly be those passing along, or in fields behind, the sea wall. It is said, however, that at times the smell from this foreshore is perceptible at a considerable distance, and in the town of Sheerness itself. At the dates of my inspection there was little or no smell from the Lappel; I had no opportunity of judging from personal observation whether the nuisance complained of is properly to be regarded as prejudicial to the inhabitants of Sheerness.

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The Thames estuary foreshore, below the sea wall along the north front of Sheerness, cannot be said to be fouled, to any extent likely to create nuisance, by the discharge of sewage from the Shone outfall near Garrison Point.

As to (*b*), shellfish. A Sheerness fishmonger rents from the lady of the manor the right of collecting shellfish on the Lappel. He informed me that he collects nothing but "winkles," all of which are boiled before sale. There is evidence that cockles and other shellfish are occasionally collected from the Lappel by boys or other unauthorised persons. There can be no doubt that raw or insufficiently cooked shellfish from this foreshore are likely to be dangerous to persons consuming them. Until recently oysters were deposited in the town moat, which is filled from the Medway, but this practice has very properly been stopped by the military authorities, in consequence of a report on the subject in October, 1904, by Major J. C. Weir, R.A.M.C.

During the ebb no risk to shellfish other than those mentioned appears to arise; the tide runs out of the Medway, past Garrison Point, in a strong current towards the middle of the Thames estuary. When the tide begins to flow, however, sewage discharged from the West Minster outfall, no doubt greatly diluted, would apparently be carried into the mouth of the West Swale, past Queenborough, and it is possible that in this manner risk of pollution of oyster layings in the West Swale above Queenborough may arise. In the absence of evidence from float experiments, or from observations, however, I am unable to express an opinion on this point.

With regard to the Shone outfall into the Thames estuary, it is evident that this outfall sewer was designed with the object of allowing the sewage to be carried as directly as possible into the strong current above referred to, and so out to sea during the ebb. When the tide is flowing, any sewage discharged would apparently be carried westward round Garrison Point and then southward up the Medway, not up the Thames. The only shellfish which seem to come into question in connection with this outfall are oysters on a laying near Cheyne Rock, Marine Town. These layings are a little over a mile east by direct line from the Shone sewer outfall; the oysters laid there are not sold locally, but are native oysters laid in the spring and taken up at intervals between November and January by a merchant in West Mersea. Local statements varied as to the existence, at any state of tide, of an eddy which would direct sewage from the Shone outfall towards the shore near Cheyne Rock; the "watcher" of the oyster layings was very positive in his opinion that no such eddy exists. The matter does not appear to have been tested by float experiments or other systematic observations.

Scavenging.—House refuse is collected daily, or every alternate day, by scavengers employed by the District Council. Householders usually deposit their refuse in broken boxes, old tins, or other unsuitable receptacles, with the result that refuse often gets scattered about the yard before the arrival of the scavenger's

cart. Refuse is burnt in a destructor furnace at the water-works in Mile Town, and furnishes a source of heat to the boilers.

Milk Shops; Bakehouses; Slaughter Houses; Inspection of Food.—Nearly all milk is obtained from farms outside the urban district. The *milk shops* of the place (usually general shops doing only a small counter trade in milk) do not appear to be registered as required by the Dairies, Cowsheds, and Milkshops Order of 1885. The District Council at one time decided that regulations should be made under this Order, but do not appear to have pursued the matter further. Some of the *bakehouses* which I saw were satisfactory as regards structure, drainage, ventilation and cleanliness; one bakehouse in Mile Town was in regard to all these matters in a very objectionable state. There are seven *slaughter houses* in the town. Nearly all are undesirably close to dwellings, and local complaint arises in consequence. Yards and approaches are generally badly paved. Some of the slaughter houses are merely old timber sheds; in one or two instances their floors are very uneven, and in nearly every case the arrangements for supply of water are inadequate. The receptacles provided for offal are usually unsatisfactory for the purpose, and have no covers. In the Co-operative slaughter house at Cheyne Rock there is a blood-pit within the slaughter house, the contents of which at the date of my inspection were extremely offensive. In this and in some other instances the premises had been very indifferently cleansed after the last slaughtering. A copy of the local byelaws with regard to slaughter houses (made in 1857 by the Local Board of Health) was found for me at the District Council's Offices. These byelaws enable certain of the above matters to be dealt with by the Council; in practice however they are not enforced. *Unsound meat* or other food exposed for sale has on occasion been seized by the Medical Officer of Health as unfit for human food. I examined the throat and neck glands of about a dozen pigs in different butcher's shops; in two instances there was evidence of the presence of tubercle in tonsils or submaxillary glands. In 1903 and 1904 the County Council's inspector took in Sheerness, for analysis under the *Sale of Food and Drugs Acts*, 54 and 19 samples respectively of different foods and drugs. Of these, six (three being milk samples) were reported as "adulterated."

Common Lodging House.—There is one common lodging house in Sheerness, which makes provision for a maximum of 21 lodgers In the upper room of this house the air space allowed at the date of my visit was insufficient—less than 200 cubic feet per bed. The arrangements for washing were also unsatisfactory. The District Council possesses bye-laws regarding common lodging houses (made by the Sheerness Local Board in 1887) which, however, do not appear to be enforced.

Procedure with regard to infectious diseases; disinfection; hospital isolation.—No attempt is made by the District Council to isolate cases of infectious disease (other than small-pox) in hospital. In the case of dwellings invaded by scarlatina and diphtheria, I am informed that, as a matter of routine, inquiries

are made by the Medical Officer of Health or by the Assistant Inspector of Nuisances with a view to exclusion of children from school, and similar precautions. In such cases disinfectants are supplied by the Council to the household so long as required, and on the termination of the case the room or rooms occupied by the patient are disinfected with sulphur dioxide by the Assistant Inspector of Nuisances. As regards enteric fever, with which my inquiries were specially concerned, I found that all cases had been treated at their homes, and nearly always had received daily visits from one or other of two "Queen's nurses" in Sheerness, who are maintained by the subscriptions of a local nursing society. In most instances the entire business of arranging for isolation (so far as such was practicable) at the home, and of giving instruction and assistance with regard to the disinfection of excreta, soiled linen and clothing, had been undertaken, independently of the sanitary authority, by these nurses in co-operation with the medical practitioner in whose care the patient happened to be. Good work had evidently been done by the nurses in this way. Disinfecting solutions could be obtained by the householder on application at the District Council offices. In certain instances inquiries had been made by the Medical Officer of Health as to the circumstances associated with the occurrence of enteric fever. The room or rooms occupied by the patient had usually been cleansed and disinfected on the termination of the case: sometimes I found that this had been carried out by the Assistant Inspector of Nuisances; in other instances no visits had been made to the invaded dwelling by any officer of the sanitary authority, and such cleansing and disinfection as was undertaken after the recovery or death of the patient had been independently carried out by the householder. House drains of invaded dwellings had not been examined or tested. The District Council do not possess a *disinfecting apparatus*. In certain instances (but not apparently in enteric fever cases) infected bedding has been destroyed and compensation given.

The Council have some makeshift arrangements for *hospital isolation*, which are utilised for smallpox cases. Their "hospital" adjoins the sewage tanks at West Minster. It consists of two attached cottages, of which one is occupied by a man employed at the sewage works; the other has on the ground floor a kitchen and nurses' bedroom, and upstairs a room which can be arranged as a ward with two or three beds. These cottages, together with a small area of land adjoining them, are enclosed by a 6-foot galvanized iron fence. Within this enclosure is a galvanized iron building, comprising a single ward, bathroom, and closet, which was erected three years ago, and has not yet been used for patients.

A *Public Mortuary* has recently been erected in Mile Town, on a portion of land, belonging to the District Council, which adjoins the National School.

Outstanding Loans; Rating; General District Rate and Government contribution thereto.—At the end of 1904 the balance of outstanding loans in respect of the Sheerness Urban District was £50,800. The annual assessable value of the town

in 1904 was £41,825. To this may be added £10,532, the present amount fixed by the Government valuer as the basis for calculation of the annual contribution which is made by the Treasury in respect of various Government property on which rates are not chargeable. Taking account of the Government contribution, a penny rate brings in about £200. The General District Rate for the year ended September, 1904, was 3*s*. 4*d*. in the pound.

District Council and Sanitary Staff.—The District Council consists of 12 members, some of whom are employed at the Dockyard, and others are engaged in business or trade in the town. Questions of sanitary administration are usually dealt with by the Council as a whole: in some instances they are first referred to a Sanitary Committee. The Medical Officer of Health, Dr. C. Arrol, has held the office, under the District Council and the Local Board which preceded it, since 1882. His salary is £60, half of which is repaid from County funds. In addition to private practice, Dr. Arrol undertakes certain medical duties for the War Department, is District Medical Officer and Public Vaccinator, and Medical Officer of Health for the Borough of Queenborough (population 1,544). The Surveyor, Mr. T. F. Berry, before his appointment to the office in 1899 had experience in building and contractors work and had been employed for some years by the Council. Mr. Berry is responsible to the Council for waterworks and water-supply, dust destructor, sewers, sewage pumping, sea walls, and a variety of other matters which appear fully to occupy his time. As surveyor he receives a salary of £140 and a house. In addition he receives £80 a year, half of which is repaid from County funds, as Inspector of Nuisances. In practice, however, such Inspector of Nuisance work as is performed in Sheerness is mainly carried out by an Assistant Inspector of Nuisances, Mr. R. D. Stannard, appointed in 1902, who receives 25*s*. a week. Before his appointment Mr. Stannard was in the police force. The greater part of his time is occupied in supervising the arrangements for refuse collection and street cleaning. He also has certain duties as regards hydrants and sewer flushing. He makes inquiries and serves notices in cases where nuisances have arisen from blocked water-closets, house drains, or gullies, and on occasion he disinfects premises.

Adoptive Acts and Byelaws.—The Infectious Disease (Prevention) Act, 1890, and Part III. of the Public Health Acts Amendment Act, 1890, were adopted in January, 1891. No byelaws as to supply of water to closets, paving of yards, &c., have been made under the latter Act. The byelaws of the district which relate to sanitary matters are in respect of Slaughter Houses (allowed 1857); New Streets and Buildings (1868); Keeping of Animals (1882), and Common Lodging Houses (1887).

PART III.—OBSERVATIONS AND RECOMMENDATIONS.

From a health point of view, Sheerness possesses certain valuable assets. The coast on which it stands is swept by sea breezes, and has a good reputation for healthiness; the marshes

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behind it are now well drained; the bulk of its population has the advantage of regularity of employment at healthy occupations; there is little poverty in the strict sense of the word; the inhabitants, by co-operation in a variety of important industrial societies, clubs, and the like, have done much to improve the conditions, or add to the conveniences, of their life in the town.

On the other side of the scale must be placed the existence of such serious insanitary conditions as those indicated in Part II. of this report. Many of these conditions are of the kind which conduces to endemic prevalence of enteric fever, and also occasions risk of definite epidemics of this disease. Apart from enteric fever, however, the conditions in question cannot be otherwise than gravely prejudicial to the health and to the general welfare of the inhabitants of the town.

This is especially the case in respect of the condition of dwellings and their surroundings. Already certain dwellings in the district must be regarded as incapable of being made fit for human habitation. These dwellings are at present relatively few, but there are many others which, in the absence of action by the District Council under the Housing of the Working Classes Acts and other powers which they possess or can obtain, are likely within a few years to come within the same category. The fact that many residents are compelled to take what house accommodation they can get, regardless of its nature, appears to me to add to the obligation of the District Council to take action in these matters. Some defects of the older property—*e.g.*, wetness of site and absence of through ventilation—cannot easily be remedied. But it is within the power of the Council to see that dwellings have eaves gutters and down spouts, roofs which do not let in rain, floors and window frames which are reasonably sound, and the like. There can be no question also of the gain which would result to health and cleanliness by requiring proper paving and channelling of yards (a matter of special importance in nearly all parts of Sheerness in view of the closeness with which dwellings are packed on area), relaying of defective house drains, and provision of flushing apparatus to closets. I anticipate that it will be objected that the task here is too big; that in Sheerness most yards are badly paved, most house drains leak, and most closets are without the means of flushing, and consequently that opposition of property owners and householders may be expected to prevent the District Council from demanding universal and immediate amendment in these matters. This may be granted, but it is no reason for continuing to do nothing. Cases can be considered on their merits. Much good will ultimately result if each year's work brings about a substantial reduction in the insanitary condition of those premises which from the point of view of health are the most objectionable.

In Part II. I have indicated other matters which obviously call for better administration by the District Council: application of more satisfactory and systematic methods of prevention where cases of infectious sickness are reported; better supervision with

regard to slaughter houses, bakehouses, milk shops, common lodging houses, and construction of new dwellings. The chief reasons for past administrative neglect, both as regards condition of dwellings and the other matters just mentioned, appear to me to be the weakness of the present sanitary department and the absence of co-operation between that department and the District Council. The Council when dealing with matters on which the Medical Officer of Health would have been able to put special knowledge at their disposal, have frequently not sought his opinion. Taking recent instances, for example, they did not consult him as to the position of the dust destructor in the town, as to the structure and position of the new public mortuary, or even as to the situation and character of the isolation hospital buildings, or the accommodation which the hospital was to provide. On the other hand, the Medical Officer of Health has often failed to use the opportunities which he possesses of drawing attention in annual or special reports, or in the memoranda which he submits to the Council at their fortnightly meetings, to prevalent insanitary conditions in the town, or to special needs for administrative action. The cause is not far to seek: practically speaking, there is no sanitary inquiry officer, no Inspector of Nuisances, in Sheerness. Insanitary conditions are not reported because they are not looked for; while in the matter of precautions against spread of infectious diseases the Medical Officer of Health is without adequate assistance.

I am convinced that the most pressing sanitary need of Sheerness is the appointment, at adequate salary, of a properly-trained and fully-qualified Inspector of Nuisances, to give his whole time to the duties of the office. I am unable to recommend the Board to continue to sanction expenditure of county funds in repayment of half the salary of the present Inspector, whose duties are delegated to an untrained deputy, and who himself has neither the time nor the training necessary for the work required. Having regard to the period during which the District Council, and the Sheerness Local Board before it, have had the services of the present Medical Officer of Health, it is not unlikely that before long the question of a new appointment to the office will arise. When this happens, the Council, in my opinion, would be wise to inquire in the first instance as to the practicability of securing the services of a medical officer of health not engaged in private practice, and giving the whole of his time to public health or kindred work. For example, the appointment, with the assent of the local authorities concerned, of the Medical Officer of Health of the Milton and Sittingbourne combined district, which is now in course of formation, or of the Assistant Medical Officer of the Port of London Sanitary Authority (the Corporation of London) who is required to reside in Sheerness, might both advantageously be considered in this connection.

Another matter of much importance is the provision of a continuous water service in substitution for the present wasteful, inconvenient, and in some circumstances dangerous, intermittent supply. For this purpose the District Council would do well in the first instance to obtain expert engineering and geological

advice with regard to (*a*) the total quantity of water which it would be necessary to supply to Sheerness on a constant service, assuming adequate precautions to prevent waste; (*b*) the yield which may be expected from the present wells and pumps, and the nature and cost of any additional works requisite in order to furnish a continuous supply.

It will evidently be necessary for the District Council at an early date to carry out works of repair at the sewage tanks at West Minster, and to arrange that the pump at present in use should be supplemented to whatever extent is necessary to guard against breakdown or exceptional inflow of storm sewage to the tanks.

Summary.—The following summarises the principle of the above recommendations :—

(1) Re-organisation of the Sanitary Department. Appointment of a well-trained and qualified Inspector of Nuisances, to give his whole time to the duties of the office. Arrangements, when opportunity affords, with other sanitary authorities by which the District Council can obtain the services of a Medical Officer of Health giving his whole time to public health or kindred duties.

(2) Action by the District Council, with the advice and assistance of an improved sanitary department, to remedy insanitary conditions of dwellings and their surroundings, and other objectionable circumstances of the district referred to in Part II. of this report, and to apply more effectual methods to the prevention of infectious disease.

(3) Revision of present code of byelaws and adoption of byelaws under the Public Health Acts Amendment Act, 1890. Adherence of the Council to their own byelaws, and enforcement of such byelaws in the district.

(4) Obtaining expert advice as to the conditions in which the present system of intermittent water supply can be replaced by a satisfactory and continuous public water service, with a view to suitable action.

ADDENDUM 1.

ANNUAL ATTACK RATES FROM ENTERIC FEVER IN THE LARGER TOWNS OF ENGLAND AND WALES, 1898–1904.

In the table below are given the annual attack rates from enteric fever in certain larger towns in England and Wales during the years 1898 to 1904 inclusive. The middle year, 1901, is the census year, and the rates have in each instance been reckoned on the 1901 census population. The figures have been extracted and tabulated in the medical department by Mr. W. Hunter.

My colleague, Dr. Theodore Thomson, in a report to the Board on enteric fever in Swinton and Pendlebury (Annual Report of the Medical Officer of the Board for 1898–9, p. 168) gave the annual attack rates from enteric fever of 50 towns for which the necessary data were then available. For convenience of comparison I have marked these 50 towns with a * in the table below. The annual attack rate from enteric fever for the whole of these 50 towns during the period 1893–97 was 1·03.

The table below gives the annual attack rates from enteric fever from 1898 to 1904, inclusive, of :—

(*a.*) The 75 towns of England and Wales which had a population at the 1901 census exceeding 50,000. In the case of 35 of these 75 towns the corresponding attack rates for the period 1893–97 were given by Dr. Thomson in the report referred to.

(*b.*) Fifteen towns of England and Wales with a population at the last census less than 50,000, in respect of which Dr. Thomson gave the corresponding attack rates for the period 1893–97.

The total number of towns dealt with in the table is thus 90. The data also enable calculation of the following annual attack rates from enteric fever during 1898–1901 :—

All the 90 towns	0·96 per 1000.
All the 75 towns of England and Wales whose population at 1901 census exceeded 50,000...	0·97 „
All the 50 towns whose attack rates for 1893 to 1897 were given by Dr. Thomson ...	0·89 „

Towns	Population (Census), 1901.	Annual Attack Rates per 1,000 from Enteric Fever during the seven years 1898–1904.	Towns.	Population (Census), 1901.	Annual Attack Rates per 1,000 from Enteric Fever during the seven years 1898–1904.
50 Urban Districts	15,170,479	·96	*Birmingham ..	523,204	1·12
75 Urban Districts with populations over 50,000.	14,506,863	97	*Leeds	428,968	1·01
			*Sheffield [99] ..	380,793	1·73
*50 Urban Districts	10,411,007	·89	*Bristol	328,945	·65
			*Bradford	279,767	·93
*London	4,536,541	·71	West Ham	267,358	1·54
*Liverpool	684,958	1·19	*Kingston-on-Hull	240,259	·89
Manchester ..	543,872	·81	Nottingham ..	239,743	1·75

APP. A, No. 6.

Sanitary Circumstances and Administration of, and Enteric Fever in, Sheerness; by Dr. Buchanan.

Towns.	Population (Census), 1901.	Annual Attack Rates per 1,000 from Enteric Fever during the seven years 1898-1904.	Towns.	Population (Census), 1901.	Annual Attack Rates per 1,000 from Enteric Fever during the seven years 1898-1904.
*Salford	220,957	1·27	York [00]	77,914	1·55
Newcastle-upon-Tyne [98].	215,328	·50	*Aston Manor ..	77,326	1·56
Leicester [98] ..	211,579	·61	Reading	72,217	·35
Portsmouth [00] ..	188,133	2·38	*Hornsey	72,056	·37
Bolton	168,215	1·30	*Devonport	70,437	·56
*Cardiff	164,333	·50	*Coventry [99] [01]	69,978	·95
Sunderland [98] ..	146,077	1·73	*Merthyr Tydfil [03]	69,228	2·34
Oldham	137,246	·48	*Newport (Mon.) ..	67,270	·69
Croydon	133,895	·37	Ipswich [99] ..	66,630	1·65
Blackburn	127,626	1·24	Hastings [99] ..	65,528	·32
Brighton [99] ..	123,478	·65	*West Bromwich [00].	65,175	·93
Willesden	114,811	·54	Warrington [00] ..	64,242	·78
Rhondda	113,735	2·56	*Grimsby	63,158	4·06
Preston	112,989	1·48	*West Hartlepool ..	62,627	·38
Norwich [98] ..	111,733	1·24	Hanley [99] ..	61,599	1·19
Birkenhead ..	110,915	1·76	Wigan [99]	60,764	1·48
Gateshead [98] ..	109,888	·51	Bootle [98]	58,556	1·30
*Plymouth [00] ..	107,636	·62	Bury	58,029	·70
Derby	105,912	1·00	*Barrow-in-Furness	57,586	1·09
Halifax	104,936	·66	King's Norton and Northfield.	57,122	·51
*Southampton ..	104,824	1·20	*Smethwick	54,539	·91
*Tottenham	102,541	·93	Rotherham	54,349	1·28
*Leyton	98,912	·89	Wallasey [01] ..	53,579	10
*South Shields ..	97,263	1·06	Handsworth (Staffs.)	52,921	·55
Burnley	97,043	·82	Stockton-on-Tees	51,478	1·26
East Ham	96,018	1·14	*Tynemouth ..	51,366	·45
*Walthamstow ..	95,131	·90	Great Yarmouth [98].	51,316	2·00
Huddersfield ..	95,047	·62	*Burton-on-Trent [01].	50,386	·54
Swansea	94,537	·86	*Bath	49,839	·29
*Wolverhampton ..	94,187	1·29	*Oxford [98] [00] ..	49,336	·25
*Middlesbrough [98]	91,302	1·40	*Southport	48,083	·70
*Northampton ..	87,021	·56	*Gloucester	47,955	·17
*Walsall	86,430	·83	*Exeter [99]	47,185	1·51
*St. Helens [99] ..	84,410	1·47	*Bournemouth ..	47,003	·22
Rochdale [98] ..	83,114	·45			
*Stockport [98] ..	78,897	·81			

Towns.	Population (Census), 1901.	Annual Attack Rates per 1,000 from Enteric Fever during the seven years 1898-1904.	Towns.	Population (Census), 1901.	Annual Attack Rates per 1,000 from Enteric Fever during the seven years 1898-1904.
*Worcester	46,624	·37	*Barnsley	41,086	2·36
*Carlisle	45,490	·32	*Cambridge [98] ..	38,379	·71
*Darlington	44,511	1·20	*Colchester	38,373	·51
*Eastbourne	43,344	·35	*Macclesfield [00] ..	34,624	·95
*Dover	41,794	·31			

* Fifty Urban Districts for which attack rates from enteric fever in 1893-97 were recorded by Dr. Thomson in the Annual Report of the Board's Medical Officer for 1898-9, p. 166.

[97], [98], &c. In the year indicated the number of enteric fever cases notified exceeded one-quarter of the total number of enteric fever cases notified during the seven years 1898-1904.

ADDENDUM 2.

Notes on Calculation of Death Rates in Sheerness.

The total population of the area comprised in Sheerness Urban District at the last three Census was as follows :—

——	1881.	1891.	1901.
Males	7,760	7,730	10,933
Females	6,526	6,762	7,246
Total	14,286	14,492	18,179

In the above figures are included :—

——	1881.	1891.	1901.
A. Naval barracks	381	202	824
B. Military barracks	607	742	856
C. Afloat on ships of Royal Navy	519	719	2,110
D. Afloat on merchant vessels and barges	246	210	96
A, B, C, and D. Males	1,564	1,775	3,728
A, B, C, and D. Females	189	168	158
Total	1,753	1,943	3,886

The populations remaining, after deduction of A, B, C and D, were :—

SHEERNESS URBAN DISTRICT, excluding NAVAL and MILITARY BARRACKS and FLOATING POPULATION.

	1881.	1891.	1901.
Males	6,196	5,935	7,205
Females	6,337	6,594	7,088
Total	12,533	12,549	14,293

Seeing that the naval, military, and floating populations in question are technically included among the inhabitants of the Urban District of Sheerness, no objection can properly be taken to the calculation of death rates in which these populations, and deaths among them, are added to the reckoning. It is desirable, I think, that the Medical Officer of Health should continue to include these populations when compiling the usual Table I. of his Annual Reports. But it should be remembered that :—(A) the bulk of the population in the Naval Barracks consists of men drafted for a few months to the Gunnery School This population seldom contributes any of the deaths which occur in the Urban District of Sheerness; serious cases of illness or accident are removed to the Royal Naval Hospital at Chatham. (B) The population of the Military Barracks is more permanent than that of the Naval Barracks. It consists mainly of young adults, and also includes some soldiers' families. But the whole of this population contributes few deaths to the Urban District of Sheerness: the annual total of such deaths during recent years has, on an average, been only some 5 or 6. (C) the magnitude of the population afloat on ships of the Royal Navy varies almost from day to day. Neither this nor the small population on merchant vessels and barges (D) appear to contribute deaths which occur in the Urban District, save in the case of fatal accidents or other exceptional occurrences.

In order that death rates (whether "general" death rates or death rates from specified diseases) may be obtained which are comparable with those of other towns, it would be an advantage if future Annual Reports of the Medical Officer of Health were to furnish rates in the calculation of which are excluded (1) all four populations A, B, C and D, above; (2) such deaths as have been recorded among these populations during the year.

As regards the general death rate. it may be observed that cases occur from time to time in which Sheerness residents who are seriously ill have gone to hospitals in London or in Rochester, where they have died. It should also be noted that a certain number of the men employed at the dockyard—particularly those not on the establishment—leave the town when they have got past work. Observations as to the extent to which these circumstances may have tended to reduce the general death rate of the district might usefully be included in future Annual Reports of the Medical Officer of Health.

ADDENDUM 3.

WELL SECTIONS AND WATER ANALYSES.

The following well section is recorded by Mr. W. Whitaker, F.R.S., (Kentish Well Sections in the Rochester District: Reprinted from the Rochester Naturalist, Nos. 71 to 73, Vol. III., 1901). The well in question is that referred to as "Garrison Well" in this Report (p. 8).

Sheerness.—War Department Pumping Works, Fort Townshend. New well, about 23 feet from old well.

Communicated by Lieut.-Colonel E. C. Sim, R.E.

Shaft sunk in 1869 to a depth of 204 feet. Boring began January 1877.

Slight spring of water at 736 feet. At 806 feet water rose to 69½ feet from the surface. Water rises to about 80 feet. Yield about 4,000 gallons an hour.

		Thickness.	Depth.
From surface, through London Clay [capped by Alluvium, &c.].		338	336
Black Clay and Sand [? base of London Clay]		2	338
OLDHAVEN BEDS, 20 feet?	Green Sand and Clay	12	350
	Grey Sand	8	358
WOOLWICH AND READING BEDS, 42 feet?	Black Sand	1	359
	Light-coloured Clay	3	362
	Green Sand	4	366
	Sand-rock	5	371
	Green Sand	14	385
	Grey Sand	5	390
	Green Loamy Sand..	2	392
	Dark Grey Sand	3	395
	Green Sand	5	400
THANET BEDS, 101 feet?	Dark (Black) Sand..	22	422
	Dark Sand and Rotten Shell intermixed.	32	454
	Soft Sand-rock	23	477
	Dark Blue Sandy Clay	24	501
Chalk and Flints..		305	806

[It is difficult to mark the divisions of the Tertiary Beds, even with the aid of the new Town well.]

In the same paper Mr. Whitaker gives additional details regarding the Dockyard "New" well, which he had already described in Vol. IV. of the Memoirs of the Geological Survey, p. 469.

In the Proceedings of the Geological Association, Vol. V., No. 7, Mr. W. H. Shrubsole gives a detailed account of the strata met with in boring the "New" Town Well. He records that at 738 feet water rose to 100 feet from the surface;

on termination of the boring, at 805 feet, hard dull sticky chalk was met with, yielding no water.

The analyses which I have obtained relate to water from Garrison and Dockyard "New" Wells, both of which are bored into the chalk, and to the town water, which is mainly derived from the Town "New" Well (bored into the chalk), but partly also from the Town "Old" Well, which is bored only into Thanet sands. I have not been able to obtain analyses of water taken from the Town "Old" Well or from the Dockyard "Navy" Well. I have added, however, an analysis of a sample of water from a well at the Union Workhouse, near Minster, about two miles from Sheerness. This well is said to be carried into, but not below, the Thanet sand.

Well.	Analysed.	Parts per 100,000.							Remarks.
		Total Solids.	Hardness.		Chlorine.	Free Ammonia.	Albuminoid Ammonia.	Oxygen absorbed.	
			Total.	Fixed.					
Garrison Well	War Department, 1877.	61·0	9·0	2·0	12·82	0·0	0·0	—	Clear. Small sediment of sand; trace of iron.
Garrison Well	War Department, 1900.	59·0	8·0	6·0	13·5	0·074	0·005	0·0296 [15 min. at 80°].	Clear. Small deposit of sand.
Navy "New Well."	Haslar Laboratory, May, 1900.	63·0	6·6	2·2	7·6	0·15	0·08*	0·0 [3 hrs.]	Slight turbidity. Scarcely perceptible sediment.
Town Supply	Haslar Laboratory, May, 1900.	72·0	17·4	7·4	6·2	0·084	0·034*	0·024 [3 hrs.]	Slight turbidity. No sediment.
Town Supply from Service Tank.	Mr. J. Muter, July, 1904.	60·0	11·7	0·0	6·43	0·04	0·004	0·059 [4 hrs.]	Alkaline reaction, and contained 17·5 parts per 100,000 of sodium carbonate.
Sheppey Union Well, 450 feet.	War Department, 1900.	63·5	6·0	5·5	7·6	0·0	0·0	0·006 [15 min. at 80°]	Clear. Small sediment of sand and vegetable débris.

* These figures are as they appear in the Laboratory records, but it seems probable that they are in fact parts per million, not parts per 100,000.

G. S. B.

No. 7.

REPORT on SMALL-POX in the DEWSBURY UNION; by Dr. S. W. WHEATON.

The Dewsbury Union comprises the municipal boroughs of Dewsbury, Batley, Morley, and Ossett; and the Urban Districts of Birkenshaw, Birstal, Gomersal, Heckmondwike, Liversedge, Ravensthorpe, Mirfield, Thornhill, Soothill Upper, and Soothill Nether.

The Union has an area of 25,564 acres, and had in 1901 a population of 167,643 persons. The population is chiefly aggregated in the boroughs. Some of the urban districts are very sparsely populated; Thornhill, for instance, has a population of less than three persons per acre, as also Birkenshaw. On the other hand Dewsbury has a population of over 19 persons per acre and Ravensthorpe U. one of nearly 16 persons per acre. The town of Dewsbury occupies approximately the centre of the Union and here is situate the workhouse. The town is surrounded by the urban districts of Ravensthorpe, Mirfield, Liversedge, Heckmondwike, Soothill Upper, Soothill Nether, Thornhill, and the borough of Batley. Dwellers in these surrounding districts are to a large extent employed in Dewsbury in the daytime. This town is a centre of the heavy woollen trade and of the manufacture of clothing from all kinds of waste products; a large part of its area is occupied by mills and other factories so that there is little doubt that if the area occupied by these could be deducted the number of persons per acre would be greatly increased. Similarly, in the urban district of Ravensthorpe, buildings in which are practically continuous with those of Dewsbury, a large portion of the area is occupied by mills and factories.

For a long time Dewsbury town has been the centre of a movement in opposition to vaccination, and the surrounding urban districts have participated to a greater or less extent in this opposition. The guardians of the Dewsbury Union have not only persistently neglected carrying out their duties under the Vaccination Acts, but have even taken up an attitude of opposition to the laws to which they were intended to give effect, with the result of very greatly discouraging the practice of vaccination.

On April 20th, 1904, in reply to a communication from the Board asking what steps the guardians had taken to secure vaccination and re-vaccination in view of a small-pox outbreak, the Dewsbury guardians replied that they did not consider it expedient or necessary to take any steps to secure vaccination or promote re-vaccination among the residents in the locality where the cases of small-pox had occurred. The outbreak still continuing the Board wrote again to the guardians on September 22nd, pointing out that owing to the prevalence of small-pox it was very desirable in order to increase the facilities for obtaining vaccination that the guardians should at once arrange for the

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opening of a station in the centre of Dewsbury with evening attendances there by the Public Vaccinator for the performance of re-vaccination and of primary vaccination of adults and children over one year of age, and pointing out that in view of the increasing demand in Dewsbury for vaccination and re-vaccination a considerable saving on the cost of the operations would probably be effected by this course if adopted. About this time the Public Vaccinator was busily engaged in vaccinating and re-vaccinating, performing about 100 operations daily, and he also made representation to the guardians, pointing out the great saving in cost which would follow if the guardians would provide a central vaccination station, since the fees for operations performed at such a station would only be half of those performed at the persons own homes. In spite of the advice tendered them the guardians did not open a vaccination station or take any measures for encouraging vaccination and re-vaccination. At this time each case of small-pox was followed by the vaccination or re-vaccination in large numbers of the persons living in the neighbourhood of the infected house and of persons who had been in direct contact with the sufferer; but there was no general vaccination or re-vaccination of the population of the town. All vaccinations and re-vaccinations having to be performed either at persons homes or at the Public Vaccinator's surgery, which was in an inconvenient position owing to its distance from the centre of the town, there was much loss of time both to the Public Vaccinator and also loss of time and delay to those who wished to obtain promptly the protection of vaccination and re-vaccination against small-pox.

Acting under the Board's instructions I visited those places in the Dewsbury Union in which small-pox was most prevalent or in which outbreaks of the disease occurred from time to time and tendered advice to the Authorities and their officials as to the measures to be taken for preventing the spread of the disease.

This report is intended to give a short outline of the conditions which I found and of the action taken by the Authorities up to the end of October, 1904.

Hospital provision for small-pox in the Dewsbury District.—Certain districts around the town of Dewsbury were united with that borough to form a Joint Hospital District by a Provisional Order made in 1893. The authorities thus combined are Dewsbury Borough and the urban districts of Heckmondwike, Ravensthorpe, Soothill Upper, and Soothill Nether. This Joint Hospital Board had at the time of my first visit to Dewsbury on September 14th, 1904, made no provision for small-pox. The component authorities, other than Dewsbury, together with the urban districts of Mirfield and Liversedge, had been relying upon a promise from Dewsbury Town Council that they would admit cases of small-pox from neighbouring districts to the Town Council's hospital situate in the borough of Dewsbury. When, however, the number of cases rapidly increased, and when a temporary hospital building of theirs was destroyed by fire, the Dewsbury Town Council had in self-defence to refuse to take any cases of small-pox from outside districts into their hospital. In

these circumstances an application was made to the Board for permission to use, for the reception of small-pox, a hospital for ordinary infectious diseases which was in course of erection in the district of Soothill Upper by the Joint Hospital Board. An undertaking having already been given to the Board that this hospital would not be used for small-pox, and the situation of this hospital being such that there were many dwellings, a colliery, and a factory within a quarter of a mile, and a population of at least 2,088 persons living within half-a-mile of it, the Board were unable to accede to this request and to release the Joint Hospital Board from their undertaking.

The Board, on September 22nd, 1904, wrote to the Joint Hospital Board urging them to at once take steps to secure a site, on which to treat small-pox cases, so situated as to minimise the danger of spreading the disease from the hospital to persons residing in its neighbourhood. The Joint Hospital Board were, however, very slow in taking action, and at the end of October no small-pox accommodation had been provided by them.

Small-pox in Dewsbury Borough, population (1901) 28,060.—For many years past outbreaks of small-pox have from time to time occurred in Dewsbury; in 1892 there was 272 persons attacked, with 45 deaths; in 1903 there were 240 persons attacked, with 17 deaths. In 1904, to September 14th, the date of my first visit to Dewsbury, there had been 260 attacks of small-pox. All of these sufferers had been admitted to the hospital, together with 48 other persons from neighbouring urban districts. The disease appeared to be on the increase; thus in the week ending August 27th 10 attacks had been notified, whereas in the weeks ending September 3rd and 10th 40 attacks and 41 attacks respectively had been notified. I conferred with the officers of the Town Council and with some of its members, and I visited the town small-pox hospital accompanied by Dr. Clay the medical officer of health. Although small-pox had been prevalent in the borough since the end of February of the present year, I found that the administration of the Town Council in respect of small-pox prevention remained defective in various particulars, the most important of which were (1) that there was no efficient disinfection of the clothing of "contacts," *i.e.*, those persons who had been living with the sufferer from small-pox at the time when he was attacked by the disease; (2) that no provision had been made for the temporary accommodation elsewhere than at their homes of persons, "contacts," from infected houses whilst their clothing and dwellings were being disinfected. In consequence of absence of this latter provision the whole of an infected house could not be disinfected, but only the room which had been occupied by the patient. The disinfection of rooms moreover was not thorough, fumigation with sulphur only being employed without the use of any liquid disinfectant by means of a spray or otherwise and without stripping of the paper from the walls. The time of the Inspector of Nuisances was largely taken up in working the disinfector at the hospital, to which patients' infected clothing and bedding were removed, to the detriment of his work of supervising disinfection of infected houses.

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The town small-pox hospital is situate in the borough in an unoccupied portion of the cemetery and close to the boundary between Dewsbury borough and Ravensthorpe Urban District. Its condition was very unsatisfactory. Although an interval of several weeks had occurred at the beginning of the year during which the hospital contained no patients, the Town Council had taken no steps to cleanse it or to put it in repair so that it would be ready in case of a fresh outbreak of small-pox. It was surrounded on three sides by an open rail fence, but there was no fence on that side facing the occupied portion of the cemetery; hence a particular patient found no difficulty in escaping at night time from the hospital, with the result that he was discovered at his home having supper with his relatives. The hospital consisted of a collection of small galvanised iron buildings, and had a very dilapidated and forbidding appearance; nearly all the windows were broken, the apertures having been stuffed with paper or rags, and a very high fence of galvanised iron had been erected to enclose the small court in which the patients who were convalescent took the air. This fence had been provided because it was found that if the patients could be seen from the outside a crowd gathered in the neighbourhood and endeavoured to communicate with them. A fetid smell was noticeable outside the hospital, and heaps of refuse and partially consumed food lay around it on which starlings and other birds were feeding. On entering the building the fetor was extreme; the wards were much overcrowded, and were pervaded by flies, which arose in swarms from the patients when disturbed. The interiors of the wards were very dirty, particularly the floors of the water-closets, which were of wood boarding. The hospital consisted of six small inter-communicating wards. These contained 76 patients, overcrowding in some of the wards being very great. Two iron temporary hospital buildings, each to contain 16 beds, were in course of erection on the site. The laundry accommodation was unsatisfactory, there was no stove for drying clothing. A steam disinfecting apparatus had been provided.

The small-pox cases under treatment were some of them of very severe type; two had just terminated fatally, and it was evident that a similar termination was not far distant for several others. In charge of the 76 patients were eight nurses. A small cottage adjoining the hospital was used as an administrative building, but the accommodation was inadequate and the building somewhat dilapidated, so that damp entered the bedrooms from the roof. Some of the nurses were driven to sleeping quarters at the Moor House, a large house which had been acquired as a convalescent hospital, and where there were at the time of my visit 20 convalescent small-pox patients. This house is only 50 yards from a main road, from which it was very inadequately fenced off, but no extension of the disease appears to have taken place from it. The same could not be said of the small-pox hospital at the cemetery. There had occurred a very severe incidence of the disease upon the dwellings within a quarter-of-a-mile from the site. At Ravensthorpe railway station, which was one of the nearest buildings, the station-master and his wife were attacked with small-pox, as also were three other persons engaged at work there. That

part of the Ravensthorpe Urban District which adjoined the borough of Dewsbury, which was also the portion of Ravensthorpe nearest the small-pox hospital, had suffered from small-pox to an undue extent as compared with the remainder of the district and with Dewsbury itself.

I recommended the Town Council to provide for the disinfection of the clothing of "contacts" by means of an additional disinfecting apparatus, it being thought inadvisable to use the disinfector at the small-pox hospital for that purpose; to make provision for the temporary accommodation of persons, "contacts," whilst their homes and clothing were being disinfected; to provide for a daily visit to "contacts" by a medical man, and to have all common lodging-houses visited nightly in order to detect cases of suspicious illness. I also drew attention to the faulty administration of the small-pox hospital, and recommended that a resident medical officer should be appointed to supervise it, and to attend to the patients. I also recommended that the hospital should be cleansed and repaired, and that all hospital refuse should be destroyed in order to prevent the dissemination of infection by matters which might be blown away from the hospital site or conveyed away by rats, birds, and in such like manner. The need of increased accommodation for the nursing staff was referred to, and for the keeping of a watch to see that patients did not escape or communicate with persons outside, and so spread the infection. I also recommended the addition of chicken-pox to the list of diseases notifiable under the Infectious Disease Notification Act.

On September 25th one of the new temporary ward buildings for 16 beds was burnt down, when just at the point of completion. Fortunately no patients had been removed to it, since nothing could be done to stop the fire, and it was quickly and completely destroyed. In consequence of this the Town Council declined to admit small-pox cases from any of the outside districts, and henceforward no such cases have been admitted to this hospital, which has been reserved for the inhabitants of Dewsbury.

On October 3rd I again visited Dewsbury, and found that many of my recommendations had been adopted and carried out. A separate man had been employed to work the disinfecting apparatus at the hospital, leaving the Inspector of Nuisances free for the work of disinfecting dwellings; the method of disinfection of dwellings had been improved, but no disinfecting apparatus for the disinfection of the clothing of "contacts," nor any provision for the temporary accommodation of these persons whilst their clothing and dwellings were disinfected, had yet been provided, although I had pointed out that the Town Council should provide such accommodation. The common lodging-houses were being inspected nightly; steps had been taken for the compulsory notification of chicken-pox. No resident medical man had been appointed for the hospital. I visited the small-pox hospital again, and found it much more cleanly than formerly, some of the patients having been employed to wash the floors and cleanse the wards; the windows were being repaired; infected rubbish had been removed and was destroyed; the laundry accommodation

had been improved; and mosquito netting provided to keep the flies from the patients. The hospital was still overcrowded, but the remaining additional 16-bed ward had been completed. On the evening of my visit a resident medical man was placed in charge of the hospital in the person of Mr. M. Deane, who had been assisting the Medical Officer of Health, Dr. Clay. I again suggested that certain sheds at the town's yard should be converted into accommodation for "contacts." The Town Council adopted this suggestion and the work was begun on the following day, and when I visited Dewsbury again on the 12th of October the work was nearly completed, and a steam disinfecting apparatus was in course of erection at the town's yard for the disinfection of the clothing of "contacts." Two large sheds had been each converted into two rooms with an intervening bathroom, so that in passing from one room, which may be termed the infected side, to the other room where they received their disinfected clothing, the "contacts" were obliged to take a disinfecting bath. One set of rooms was reserved for females, the other for males. A few days later all these arrangements were completed, and the Town Council might be considered to be in a position to deal with the outbreak.

Meanwhile the Guardians had taken no action for the opening of a vaccination station, or for granting any facilities to the population for the obtaining of gratuitous vaccination or re-vaccination; or for informing people of the advantage of securing the protection afforded by vaccination and re-vaccination; or for publishing the means whereby they could obtain this protection for themselves and their children. Accordingly on October 21st the Board further strengthened the hands of the Town Council for dealing with the emergency by issuing an Order under Sections 130 and 134 of the Public Health Act, 1875. This order of course, did not supersede the powers or duties of the Guardians in regard to vaccination, but it empowered the Medical Officer of Health to perform the vaccination or re-vaccination of any person in immediate danger of contracting small-pox. It required the Town Council to provide a vaccination centre or centres for free vaccination and re-vaccination. It also required the appointment of a medical visitor for the charge of any sub-division of the borough if the Medical Officer of Health so advised, for the visitation of the borough for inquiry into the existence of small-pox, and for reporting of cases of small-pox or of suspected cases of the disease.

Up to this date, October 21st, there had occurred in 1904 412 cases of small-pox in Dewsbury, 152 of them having been reported since the date of my first visit on September 14th, and the disease appeared likely to increase.

Small-pox in Thornhill Urban District, population (1901), 10,290.—Small-pox appeared in this district early in May, 1904; afterwards the disease continued to increase and at the time of my visit on September 15th, 1904, 59 cases had occurred. The infection was attributed to Dewsbury, the two districts bordering one another for a considerable distance, and many Thornhill residents being employed in the borough. The Urban District

Council had provided a small-pox hospital, which was a temporary wood and iron building, situate in a favourable situation, far from any populous place, so that there was little risk, provided its administration was efficient, of the spread of the disease from the hospital. The hospital, which at the time of my visit contained 24 patients, was surrounded by a stone fence; it had no administrative building. It consisted of two six-bed wards, separated by a nurses' day room and kitchen; consequently the staff, which consisted of four nurses (who were untrained), had to sleep in the kitchen and nurses' room. The female side of the hospital was much overcrowded, 17 persons sleeping in 14 beds in a ward intended for six only. The male side was not overcrowded, being relieved by the erection of a tent in which the convalescent patients slept. I advised the immediate provision of more accommodation for female patients. Notwithstanding these drawbacks, the hospital was cleanly kept, in contrast to the Dewsbury hospital at the time of my first visit to it. The laundry accommodation, which was very inadequate, consisted of a small temporary building situate over the mortuary; no drying closet had been provided. There was no resident medical attendant at the hospital, but it was visited daily by the Medical Officer of Health, who lives about a mile distant. In other respects the administration of the District Council for prevention of small-pox was not satisfactory. Disinfection of dwellings was performed with formalin vapour, without any cleansing of walls and floors with liquid disinfectant. The Council possessed no disinfecting apparatus, so that the clothing and bedding of patients and the clothing of contacts could not be efficiently disinfected; and no accommodation had been provided where such persons could be temporarily received whilst their clothing and homes were being disinfected and where they could also receive a disinfecting bath. There was no medical visiting of contacts for the necessary fourteen days after their exposure to infection. It was deemed impracticable locally to keep any sufficient observation of the contacts or to detain them in their homes. In several instances persons suffering from small-pox had not been removed to hospital, but remained at their dwellings; two persons died at their own homes. I advised the Council to provide a disinfecting apparatus, as also accommodation for contacts, to arrange for the medical visitation of contacts, and other matters. I also advised, as I have said, the immediate provision of more accommodation for the female patients at the small-pox hospital, the provision of improved laundry accommodation there, including a closet for drying clothing, and better accommodation for the nurses. On the occasion of my second visit on October 13th, I found that the Council, except in the matter of accommodation for nurses at the small-pox hospital, had not carried out any of these recommendations. There were then 29 cases in the hospital, of these 14 were in the female ward, which was intended for six only; an additional tent had been provided, but the female patients had refused to stay in it because it was insufficiently warmed, and it was used, therefore, for the accommodation of the nurses. The district was one in which opposition to vaccination was formerly very rife, although on the outbreak of small-pox continuing to spread, a large number of

P. A. No. 7. persons sought the protection of vaccination and re-vaccination,
Small-pox in Dewsbury on; by Wheaton. and there was not much difficulty in securing this protection for "contacts." The total of cases in the outbreak had by now reached 84.

Small-pox in Ravensthorpe Urban District, population (1901), 5,699.—This district was visited by me on September 16th, 1904. Up to that date 46 cases of small-pox had occurred during the year, 30 of which had been removed to the Dewsbury Corporation's hospital. Since August 13th, except for a short period from September 12th to the date of my visit, Dewsbury Corporation had declined to admit more cases from outside districts, and, consequently, there were, I found, 16 persons suffering from small-pox being retained in their own homes at Ravensthorpe, and the disease appeared to be extending. The Ravensthorpe small-pox was attributed to Dewsbury, with which the district is continuous, and more particularly to the influence of the Dewsbury small-pox hospital, which was situate close to the boundary of Ravensthorpe. In the absence of any hospital accommodation for Ravensthorpe, the measures which could be taken for preventing small-pox spreading there were necessarily very inadequate for the purpose. The district is one in which there had been for a long time strong opposition to vaccination, and although large numbers of persons were now seeking the protection of vaccination and re-vaccination, these were not necessarily persons who had been most directly exposed to infection. In many instances parents refused to have their children vaccinated, although small-pox was actually present in their dwelling, and thus many secondary cases occurred. It was almost hopeless to anticipate obtaining a site suitable for a small-pox hospital in such a thickly populated district. Accordingly I strongly advised the Council to seek a site outside their district or to make arrangements with some neighbouring authority for the reception of patients from Ravensthorpe in their hospital. This they failed or were unable to do. The administration of the Council for the prevention of small-pox was found very inefficient; they had no disinfecting apparatus, consequently the clothing of contacts and the clothing and bedding of sufferers by small-pox could not be properly disinfected, and owing to the retention of small-pox cases in their homes infected dwellings could not be disinfected; in most instances members of the invaded family who were going to work sought lodgings elsewhere, other members who were children or who had no occupation remaining at home. The Council were providing the persons retained at their homes with food and firing, and were employing men to bring food to them and to keep watch on them, in order to prevent them leaving their homes and mixing with healthy people at shops and other places of public resort; also these watchers were to stay with patients who were delirious or otherwise troublesome. I advised the Council to see that all persons whom they employed in such work were duly protected by vaccination and re-vaccination. I also advised the Council to provide a disinfecting apparatus as soon as possible, so as to properly disinfect the clothing of contacts before these people were allowed to go to their work. I recommended the inclusion of chicken-pox in the list of diseases notifiable under the Infectious

Disease Notification Act, 1889, and the adoption of the Infectious Disease Prevention Act, 1889. The Council adopted these two latter suggestions.

On October 13th I again visited Ravensthorpe Urban District and found the conditions there greatly altered for the worse. Owing to the inability of the Dewsbury Corporation to admit small-pox cases from Ravensthorpe to their hospital, Ravensthorpe patients had, since September 22nd, all been retained in their homes, consequently the disease had greatly increased in the place. In the three weeks following my first visit the notified cases had been 27, 28, and 12; and in the week ending October 15th there were 25 cases. On this, my second visit, there were no less than 52 cases of small-pox retained in their own dwellings, and the Medical Officer of Health, Mr. Richardson, had been engaged by the Urban District Council to attend these persons at their own homes. The Council had also engaged several additional men to carry food to the sufferers, also to sit up with and to control those patients who were delirious in order to prevent them escaping into the streets. In spite of my advice on a former occasion the Council had not insisted upon the vaccination and re-vaccination of persons employed by them in connection with small-pox, and, as a result, three of them had already contracted the disease. In spite of this experience I found that men were still being employed on duties in connection with small-pox who had not been protected by re-vaccination. The Council were at this time spending no less a sum than £50 per week in supplying food and other requisites to "contacts" retained in their homes. I visited a number of the infected houses and found that the condition of some of the families in which the disease had occurred was altogether pitiable. Nurses had not been provided, and in many instances persons who were only just recovering from small-pox, and were quite unfit to be out of their beds, were attending on relatives who were in the acute stage of the disease. In this respect the women suffered most, since they had in addition to attending the sufferers to perform their ordinary household duties. As a rule the homes of Ravensthorpe are well furnished and the people are well off in a material sense; but few dwellings have more than two bedrooms, and hence the conditions arising where several cases of small-pox had occurred in the same household were often such as would hardly be credited as possible of existence in a civilized country. In many instances healthy people had to sleep with persons suffering from small-pox; and children were being recklessly exposed to the infection, their parents in many instances refusing to allow them to receive the protection afforded by vaccination. In one small bedroom in a particular dwelling I found three adults suffering from small-pox; one single woman aged 25 in one bed, and two single men in another; another healthy woman slept at night in the same bed with the female above referred to as suffering from small-pox. Parents still refused to have their children vaccinated, even though exposed to small-pox infection, or to themselves acquire the protection afforded by vaccination or re-vaccination; in one family six small-pox cases had occurred, in another seven. The Ravensthorpe

people appeared indeed to be quite apathetic as respects small-pox and to have become accustomed to its presence, regarding it as a calamity which it was hopeless to fight against. In one dwelling which I visited the father had himself suffered from small-pox; in one room upstairs was his son, unvaccinated, in the acute stage of the disease; in another room his wife, vaccinated in infancy by two insertions, also in the acute stage. These people were attended by the daughter, unvaccinated, aged 14 years, who was just recovering from the disease; downstairs were the youngest child who had been vaccinated, after legal proceedings by the Vaccination Officer, and who appeared quite healthy, and an elder child which remained unvaccinated. I urged the father to have this remaining unvaccinated child vaccinated; but he declined. I asked him if he was not convinced of the protection afforded by vaccination since he knew that the medical men who were constantly going in and out of the infected houses had none of them taken the disease; but he replied that the medical men were protected by a charm with which they would not part. The remaining unvaccinated child in question, I was informed, subsequently developed the disease, but the child vaccinated under pressure of the Vaccination Officer remained healthy.

Seeing that there was no possibility of the provision for Ravensthorpe of hospital accommodation for some time, that it was evident that nothing would stop an extensive epidemic except vaccination, and that the Guardians had taken no action with this object, the Board decided to issue, in regard of Ravensthorpe, an Order in similar terms to that made in the case of Dewsbury. This was accordingly done on October 31st.

Small-pox in Liversedge Urban District, population (1901) 13,980.—In 1903 16 cases of small-pox occurred in this district. Early in January, 1904, small-pox broke out again at Roberttown where 30 cases occurred. At first small-pox cases were removed from Liversedge to the hospital of the Cleckheaton Urban District Council; but after receiving six such cases this authority refused to take more, and the Liversedge Council were driven to use their hospital for ordinary infectious diseases for small-pox patients. In July small-pox broke out again in the district, and the cases, in the absence of small-pox hospital provision, had to be retained in their homes. At the time of my visit, on October 4th, 34 small-pox cases had occurred since July 8th; of these four only had been removed to hospital. In spite of previous warnings from repeated outbreaks of small-pox, the Mirfield and Liversedge Joint Hospital Board, which is the authority for hospital provision in the Liversedge district, did not provide a small-pox hospital until October. I visited this emergency small-pox hospital, a temporary wood and iron building which is situate on a site occupied partly by the hospital for ordinary infectious diseases and from which it is distant only 100 yards. The hospital comprised two wards each containing 12 beds. It is not of satisfactory construction: the observation wards, nurses' bedrooms, kitchen, scullery, lavatories and water-closets are all placed together in the centre of the building between the two wards, each of them

opening into a passage which communicates directly with the wards. This passage formed the only means of entrance to and exit from the wards. There was no fence round the hospital; a considerable amount of refuse was lying around the building, and some of this refuse was in process of being blown by the wind on to surrounding properties. There was a disinfecting apparatus on that part of the site occupied by the hospital for ordinary infectious diseases; but owing to the proximity of this apparatus to this fever hospital it was not used for articles infected by small-pox lest small-pox might be communicated to persons admitted to hospital with other infectious maladies. There was no disinfection of the clothing and persons of contacts, and no provision made for their accommodation whilst their homes and clothing were being disinfected. I advised the Council to make such provision, and to disinfect the clothing of contacts in a disinfecting apparatus. I drew the attention of the Council to the need for taking precautions to diminish the dangers of the spread of infection from their small-pox wards to the occupants of the neighbouring hospital for ordinary infectious diseases; to the need for the proper fencing in of the small-pox hospital site and to desirability of securing the destruction of all refuse and waste from it. I also advised the Council to take steps to make chicken-pox notifiable under the provisions of the Infectious Disease Notification Act, 1889, and to adopt the Infectious Disease Prevention Act, 1890. I found that vaccination and re-vaccination were in a large measure being accepted, and I advised the Council to take all possible steps to further this practice.

Small-pox in Soothill Upper and in Soothill Nether Urban Districts, population (1901) 6,104 and 5,552 respectively.

Soothill Upper Urban District.—Small-pox prevailed in this district in 1903, when 18 cases occurred, with three deaths. It recurred in September of the present year, and up to October 29th it had caused 28 cases. Owing to the inability of the Dewsbury Corporation to continue to receive outside cases of small-pox into their hospital, and to the failure of the Joint Hospital Board to provide a hospital, no small-pox cases have in 1904 been removed to hospital from Soothill Upper, except for a short period from September 12th to September 22nd. Nearly all the small-pox patients have remained at their homes. The Council had not set up a disinfecting apparatus nor made provision for accommodation of contacts whilst their homes and clothing were being disinfected; and in other respects their administration for small-pox prevention was very faulty. There is less strong opposition to vaccination in this district than in many parts of the Dewsbury Union, and I found that this protection against small-pox was now being largely sought.

Soothill Nether Urban District.—This district adjoins the borough of Dewsbury. Small-pox occurred in 1903; at least 15 cases becoming known. The disease recurred again in August of this year, and by the date of my visit on October 4th 23 cases had occurred. As in the case of Soothill Upper, and from the same causes, patients had not latterly been removed to hospital,

but were being retained in their own homes where they were attended by the Medical Officer of Health, Dr. Clay. The practice of disinfection of houses was unsatisfactory. There was no disinfecting apparatus, so that clothing of contacts could not be disinfected; there was no provision for the temporary accommodation of "contacts" whilst their clothing and homes were being disinfected, consequently these persons had to be turned out into the fields whilst their homes were being purified. I attended a joint meeting of the two Soothill authorities, at which I urged them to provide hospital accommodation pending action in this direction by the Joint Hospital Board, to obtain a disinfecting apparatus, and to provide accommodation for "contacts." Shortly after this date a site for a small-pox hospital was obtained in Soothill Upper District and a tent hospital ordered; but subsequently, finding that the Joint Hospital Board would not agree to administer this hospital and to defray the cost thereof, the project was abandoned, the site relinquished, and the tents which had been ordered were made over to the Joint Hospital Board. The Local Government Board finding that no hospital provision was forthcoming, that no action was being taken by the Guardians, and knowing that Soothill Nether Urban District adjoined the borough of Dewsbury, which was a highly-infected area, decided to issue an Order to the Soothill Nether Urban Council, similar in all respects to that issued to the Corporation of Dewsbury, with the object of facilitating prompt vaccination and re-vaccination of the population. This Order was issued on October 31st.

Small-pox in the borough of Ossett, population (1901) 12,903. Small-pox occurred in Ossett in 1903, when 15 cases came under notice. In 1904, early in March, the disease broke out again and continued to spread, until at the time of my visit, October 5th, 62 cases had occurred. All the patients had been removed to a hospital belonging to this Authority situate at Storrs Hill, on the borders of Norbury Urban District though in Ossett borough. This hospital is a permanent building consisting of two wards, each ward having a cubic space of 13,800 cubic feet; there were six beds in each ward. The hospital had at times been overcrowded, but was not so at the time of my visit. There was a laundry and disinfecting apparatus provided at the hospital. The nursing staff slept in a tent, and a tent was also provided as additional accommodation for male patients. The hospital was situate near a main road, and had about 140 dwellings within a quarter-mile of it, including a rag mill, with an estimated population of 449 persons. Within half-mile of the hospital there are, it is estimated, above 1,000 persons.

The administration of the Ossett Town Council was not found to be satisfactory. No liquid disinfectant was being used to the walls of rooms of invaded dwellings after fumigation of their interior with sulphur. No accommodation had been provided for "contacts" beyond a travelling van which would hold seven persons. There was no disinfection practised of the clothing of "contacts," no disinfecting apparatus having been used for this purpose. The district is one in which opposition to vaccination

is very great. But "contacts" in nearly all cases had accepted vaccination or re-vaccination, although neither the Guardians nor the Corporation had taken steps to further this. It was estimated that at least three-quarters of the population were unprotected by vaccination. The public vaccinator had performed 500 operations in one week. I advised the disinfection of clothing of "contacts" by means of an efficient apparatus, the provision of more suitable accommodation for "contacts," the addition of chicken-pox to the list of notifiable diseases, and other precautions.

No. 8.

APP. A, No. 8. Dewsbury Small-pox Prevention Order.

ORDER of the LOCAL GOVERNMENT BOARD embodying REGULATIONS as to SMALL-POX PREVENTION for the BOROUGH of DEWSBURY, (21st Oct. 1904.—47,563).

To the Mayor, Aldermen, and Burgesses of the Borough of Dewsbury; to the Guardians of the Poor of the Dewsbury Union; and to all others whom it may concern.

WHEREAS the Borough of Dewsbury (herein-after referred to as "the Borough") is affected by Small-pox, and, in view of the circumstances of the case, it is desirable that regulations be made for the purposes herein-after set forth:

NOW THEREFORE, We, the Local Government Board, in the exercise of the powers conferred upon Us by Sections 130 and 134 of the Public Health Act, 1875, and by the Public Health Act, 1896, and of every other power enabling Us in this behalf, do, by this Order, make the following Regulations (herein-after referred to as "the Regulations"), and Declare the Regulations to be in force in the Borough for a period of six months:—

Local Authority to enforce and execute Regulations.

ARTICLE I.—The Mayor, Aldermen, and Burgesses of the Borough, acting by the Council, and herein-after referred to as "the Corporation," shall be the Authority for enforcing and executing the Regulations, and shall forthwith make arrangements for those purposes.

The Corporation shall furnish Us with such particulars of the action taken by the Corporation at such times and in such form as We may require.

Powers, duties, and remuneration of Medical Officer of Health.

ARTICLE II.—The Medical Officer of Health shall advise the Corporation on all matters concerning the enforcement and execution of the Regulations, and shall generally superintend the execution of the Regulations.

The Medical Officer of Health may, where the circumstances, in his opinion, so require, perform vaccination or re-vaccination on any person in immediate danger of contracting small-pox, and without charge to the said person.

The Corporation shall from time to time pay to the Medical Officer of Health, in addition to the salary or other compensation payable to him in respect of his office, a reasonable compensation for all action by him in the execution of the Regulations.

Provision of Vaccination Centres.

ARTICLE III.—The Corporation shall forthwith provide a place (herein-after referred to as a "Vaccination Centre") at which persons may be gratuitously vaccinated or re-vaccinated.

The Corporation shall also provide such additional Vaccination Centres as, upon the advice of the Medical Officer of Health of the Borough, they deem necessary.

Furnishing, maintenance, &c. of Vaccination Centres.

ARTICLE IV.—(1.) The Corporation shall forthwith cause each Vaccination Centre to be fitted up, furnished, maintained, regulated and managed in such manner as may be necessary for securing the efficient performance of vaccination at the Vaccination Centre; and otherwise in such manner as may be necessary for compliance with the requirements of the Regulations.

(2.) The Corporatian shall employ such and so many servants or persons as may be needed for the maintenance, regulation and management of each Vaccination Centre in accordance with the provisions of this Article.

Public notice of Vaccination arrangements and other matter.

ARTICLE V.—The Corporation shall appoint the days on which and the hours during which each Vaccination Centre shall be opened and be kept open for the purpose of vaccination, and of the inspection of persons with a view to ascertain the results of operations, aud shall from time to time cause public notice of the days and hours during which each Vaccination Centre may be open for the purposes aforesaid, and of any other matters which form the subject or arise out of the Regulations, to be given by handbills, placards, or otherwise in such manner as may be sufficient and appropriate for affording information to all persons interested.

Employment of Vaccinators.

ARTICLE VI.—The Corporation shall employ a registered medical practitioner (herein-after referred to as a "Vaccinator") to perform vaccination and re-vaccination at each Vaccination Centre:

Provided that if the Public Vaccinator for the Vaccination District comprising the Borough is willing to accept employment under the Regulations as a Vaccinator at any Vaccination Centre the Corporation shall employ the Public Vaccinator accordingly:

Provided also that no person shall be employed as a Vaccinator under this Order unless he has obtained a Certificate of proficiency in Vaccination given by some person whom We have authorised to act for the purpose.

Application of certain provisions of Vaccination Order, 1898, and Vaccination Acts.

ARTICLE VII.—(1.) In the performance and inspection of every operation in pursuance of the Regulations, and otherwise for the purposes of the Regulations, the Medical Officer of Health and every Vaccinator shall observe the "Instructions to Vaccinators under Contract," contained in the Third Schedule to the Vaccination Order, 1898, as if he were a Public Vaccinator under Contract, within the meaning of that Order.

APP. A, No 8.

Newbury Small-pox Prevention Order.

(2.) The Medical Officer of Health who performs vaccination or re-vaccination, and every Vaccinator shall cause all vaccinations or re-vaccinations performed by him, with the results as ascertained by inspection, to be duly registered in a register which shall be in the Form O. contained in the Fifth Schedule to the Vaccination Order, 1898, with the necessary modifications, and the entries therein shall be made in the manner directed in the said Instructions to Vaccinators under Contract.

(3.) In all other respects the Medical Officer of Health who performs vaccination or re-vaccination, and every Vaccinator shall comply with all such provisions of the Vaccination Acts, 1867 to 1898, as are applicable to a Medical Practitioner who is not a Public Vaccinator.

Payments to Vaccinators.

ARTICLE VIII.—The Corporation shall pay to every Vaccinator employed under the Regulations such sum in respect of every successful primary vaccination and of every successful re-vaccination performed by him, as may be agreed upon between the Corporation and the Vaccinator :

Provided that no payment shall be made in respect of any vaccination unless the same has been performed in accordance with the Regulations, nor unless the provisions of the Vaccination Acts, 1867 to 1898, applicable to vaccinations performed by persons other than public vaccinators have been observed with reference thereto :

Provided also that no payment shall be made in respect of the re-vaccination of any person who shall be less than 10 years of age, unless the Medical Officer of Health, having regard to the special circumstances of the case, has advised the re-vaccination of the person to be necessary.

Medical Visitor.

ARTICLE IX.—(1.) If the Medical Officer of Health so advise, the Corporation shall employ a registered medical practitioner (to be called "the Medical Visitor") who shall be in charge of the Borough or any subdivision of the Borough for the purposes of the Regulations.

(2.) Each such Medical Visitor while so in charge shall act under the superintendence of the Medical Officer of Health.

(3.) The Medical Visitor shall comply with such instructions as, in accordance with the advice of the Medical Officer of Health, may be given by the Corporation with regard to—

(*a*) the visitation of the Borough or of any sub-division of the Borough or of any house in the Borough or sub-division ; and

(*b*) inquiry into the existence of Small-pox ; and

(*c*) the reporting of cases of Small-pox or suspected Small-pox.

ARTICLE X.—Any expenses incurred by the Corporation in the execution of the Regulations shall be deemed to be incurred in the execution of the Public Health Act, 1875, and may be defrayed accordingly. Expenses.

ARTICLE XI.—A person shall not wilfully obstruct the Medical Officer of Health, or Vaccinator, or a Medical Visitor in the exercise of any power or the discharge of any duty under the Regulations, and a refusal to comply with a reasonable requisition of the Medical Officer of Health, a Vaccinator, or a Medical Visitor, shall, for the purposes of the Regulations, be deemed to be a wilful obstruction of the Medical Officer of Health, the Vaccinator, or the Medical Visitor, as the case may be. Offences.

ARTICLE XII.—In this Order the expression "Medical Officer of Health" includes any duly qualified Medical Practitioner appointed or employed by the Corporation to act in the execution of the Regulations. Definition.

ARTICLE XIII.—This Order may be cited as "The Dewsbury (Small-pox Prevention) Order, 1904." Short title

Given under the Seal of Office of the Local Government Board this Twenty-first day of October, in the year One thousand nine hundred and four.

(L.S.)

WALTER H. LONG,
President.

S. B. PROVIS,
Secretary.

NOTICE.—Section 1 (3) of the Public Health Act, 1896 provides that if any person wilfully neglects or refuses to obey or carry out, or obstructs the execution of any regulation made under Section One hundred and thirty or Section One hundred and thirty-four of the Public Health Act, 1875, or in pursuance of either of those Sections as amended by the Public Health Act, 1896, he shall be liable to a penalty not exceeding one hundred pounds, and in the case of a continuing offence to a further penalty not exceeding fifty pounds for every day during which the offence continues.

No. 9.

P. A., No 9. Small-pox Gateshead & Felling, 3-4, in relation to Sheriff Hill Hospital; Dr. Buchanan.

Report on Small-pox in Gateshead and Felling, 1903–4, in relation to Sheriff Hill Hospital; by Dr. Buchanan.

In his report to the Durham County Council for the quarter ended 31st March, 1904, Dr. T. Eustace Hill, the County Medical Officer of Health, drew attention to prevalent small-pox in certain Tyneside districts of the administrative county, and referred, in particular, to a severe epidemic of that disease in Felling. This urban district, which has a population of about 23,000, adjoins the County Borough of Gateshead, where small-pox had been prevalent during the second half of 1903 and the first quarter of 1904. The portion of Felling district which had suffered most severely, Dr. Hill reported, is that which lies nearest to the Sheriff Hill Hospital of the borough of Gateshead, where Gateshead cases of small-pox had been isolated during the epidemic. Dr. Hill added, "The prevailing winds blow direct from the hospital to the Felling district, and in the opinion of the district Medical Officer of Health (Dr. W. E. Peacock) and myself there is little doubt that many of the cases of small-pox in Felling are the result of infection having been carried, probably by the wind, from the Gateshead hospital."

It was already known to the Board that the hospital concerned, although situated in a portion of Gateshead which is comparatively sparsely inhabited, has in its neighbourhood a larger total population than is desirable where isolation of small-pox is in question. And in view of these observations by Dr. Hill and by Dr. Peacock, it seemed important that the principal facts regarding the incidence of small-pox on locality should be collected and studied for Gateshead and Felling in combination. In June, when other work for the Board was taking me into Northumberland and Durham, I was instructed to make some inquiries into the subject. I had an opportunity of discussing the question generally with Dr. Hill in June; and at various dates during and since that month I visited Gateshead and Felling. Much valuable and detailed information in respect of Gateshead was supplied at my request by Dr. Clayton, the Borough Medical Officer of Health, and by his deputy, Dr. Kapp, and, in respect of Felling, by Dr. Peacock. I would also acknowledge my obligation to the surveyors of both districts for assistance in various ways.

Small-pox in Gateshead and Felling, 1903–4.

The relative positions of the County Borough of Gateshead and the Urban District of Felling are sufficiently shown in Map I. Both are industrial districts, inhabited almost entirely by a working-class population. In Felling there are some considerable areas of open country, but in the character of its inhabited areas,

and in the general nature of its dwellings, Felling closely resembles Gateshead.

The first cases of small-pox which occurred in either district during 1903 were notified from Gateshead towards the end of April. From that time to the end of May, 1904, the incidence of the disease on the two districts has been heavy. This will be seen from the following Tables, I. and II. In these tables I have for convenience divided the epidemic into four periods, as follows:—

Period I.—April 15, 1903—August 31, 1903 (4½ months).

Period II.—September 1, 1903—November 30, 1903 (3 months).

Period III.—December 1, 1903—February 29, 1904 (3 months).

Period IV.—March 1, 1904—May 31, 1904 (3 months).

TABLE I.—NOTIFIED CASES OF SMALL-POX.

Area.	Population (Census, 1901).	Notified cases of Small-pox during					Attack rate per 1,000 of population during epidemic.
		Period I. (4½ months.)	Period II. (3 months.)	Period III. (3 months.)	Period IV. (3 months.)	Whole epidemic. (13½ months.)	
Gateshead County Borough	109,888	68	41	205	196	510	4·65
Felling Urban District ..	22,467	6	14	53	82	155	6·9
Gateshead and Felling combined.	132,355	74	55	258	278	665	5·0

TABLE II.—DWELLINGS IN WHICH SMALL-POX OCCURRED.

Area.	Dwellings (Census, 1901).	Dwellings newly invaded[a] by Small-pox during					Dwellings invaded by Small-pox per 1,000 of total dwellings. (Whole epidemic.)
		Period I. (4½ months.)	Period II. (3 months.)	Period III. (3 months.)	Period IV. (3 months.)	Whole epidemic. (13½ months.)	
Gateshead County Borough	23,835	42	19	134	121	316	13·3
Felling Urban District ..	4,672	5	7	41	53	106	22·7
Gateshead and Felling combined.	27,507	47	26	175	174	422	15·3

[a] The date of "invasion" is, in the case of each dwelling, the date on which the first case of small-pox was notified from that dwelling.

P. A., No. 9.

Small-pox Gateshead d Felling, 3-4, in rela- n to Sheriff ll Hospital; Dr. chanan.

A word should be added in explanation of the figures for "dwellings" given in the second column of Table II., which in the case of each district are the census figures for "total tenements" in 1901. The usual type of house in Gateshead and Felling is the two-storied "double-flat" house. Each "flat," or storey, is a separate dwelling, separately numbered, with its own front and back entrances and its own piece of back yard. For census purposes, a self-contained house, where no room or rooms are sub-let,* is reckoned as a single "inhabited house" and also as a single "tenement"; a "double-flat" house is two "tenements," but is still a single "inhabited house." Thus, while the "inhabited house" figures give no indication of the total number of dwellings in Gateshead and Felling, the latter is closely represented† by the "total tenement" figures of the census. In order to obtain comparable data as to dwellings newly invaded by small-pox (Table II., columns 3 to 7), each flat or dwelling which has its own entrance has been reckoned as a single dwelling. It should be added that the instances in which small-pox occurred among the inhabitants of both stories of a "double-flat" house were few: there were 15 such instances in Gateshead, and only one such instance in Felling.

The case mortality of the epidemic was relatively somewhat low in both districts. In Gateshead there were 41, and in Felling there were 10 deaths from small-pox during the whole epidemic period.

The incidence of small-pox on vaccinated and unvaccinated persons, and the relative severity of the disease on vaccinated and unvaccinated has been dealt with by Dr. Peacock in his report on the epidemic to the Felling District Council, published in June last; and I understand that data on the same subjects are being prepared by Dr. Clayton in respect of Gateshead. In the two districts the total number of deaths of children under 15 was 25; only one of these (a child with congenital heart disease) had been primarily vaccinated. Of the large number of adults who were

* Lodgers boarding at the occupier's table are not reckoned as inhabiting separate tenements, although they may be occupying separate rooms.

† There are certain older houses in Gateshead and Felling which the census would compute as consisting of two or more "tenements," although these tenements are reached by common entries and stairways. In each instance, however, such houses form an insignificant proportion of the whole.

In illustration of the difference between "tenements" and "inhabited houses" in Gateshead and its neighbourhood, I have taken at random, for comparison, the 1901 census figures for six other county boroughs with large working-class populations:—

—	Population.	Total Inhabited Houses.	Total Tenements.	Proportion of Total Tenements to Total Inhabited Houses.	Persons per Inhabited House.	Persons per Tenement.
Leicester	211,579	45,551	46,162	1·01	4·6	4·55
Derby	105,912	22,983	23,230	1·01	4·6	4·57
Halifax	104,936	24,933	25,030	1·005	4·2	4·2
Middlesbrough	91,302	17,429	17,942	1·03	5·25	5·1
Swansea	94,537	18,154	19,455	1·07	5·2	4·85
Norwich	111,733	25,190	25,585	1·02	4·42	4·35
Gateshead	*109,888*	*18,721*	*22,835*	*1·66*	*5·0*	*4·8*
Felling	*22,467*	*3,301*	*4,672*	*1·42*	*6·8*	*4·8*

NEWCASTLE
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re-vaccinated during the epidemic, none were attacked by small-pox save certain of those who already had been exposed to infection at the date of their re-vaccination. In Felling no case of small-pox occurred in any person who had been re-vaccinated before the date of exposure to infection; in Gateshead there were only four such cases, re-vaccinated respectively 10, 19, 35, and 37 years previously. Two cases had been attacked by small-pox in former years.

It is unnecessary to deal in this report with the various administrative measures adopted in each district to combat the spread of small-pox, save in so far as they are related to the question of hospital influence. In both districts the epidemic was met by vigorous action, which involved a heavy strain on the Medical Officer of Health's department. Notified cases were removed to hospital almost invariably within twelve hours, and usually within a much shorter time, from the receipt of notification. Disinfection of dwellings, and of bedding, clothing, and the like, appears to have been practised systematically. "Contacts" in each invaded dwelling, and also other persons found to have been recently in association with the small-pox case, were urged to be vaccinated or re-vaccinated, as the case might be, and usually, though by no means always, vaccination or re-vaccination was accepted and was performed at an early date. A large majority of the "contacts" in both districts did not contract small-pox. In Gateshead a system of medical inspection of "contacts" (on several consecutive days about the time when symptoms of small-pox might be expected to be manifested) was organised and maintained. In Felling "contacts" were quarantined at their houses for a fortnight, the District Council supplying groceries and other articles to the quarantined family.

As the epidemic progressed the Gateshead Guardians, who are the vaccination authority both in Gateshead and Felling, made special emergency arrangements, which resulted in the vaccination and re-vaccination of many people in both districts. In the whole of Gateshead Union, between February and June, 1904, the total number of vaccinations and re-vaccinations performed at the expense of the Guardians was respectively 4,847 and 5,240; a large majority of these were in Gateshead and Felling. By this means the number of persons in both districts who were liable to attack by small-pox was unquestionably diminished, a circumstance which should be borne in mind in considering the progress of the epidemic, and the adverse influence of Sheriff Hill hospital, to which reference is about to be made.

SHERIFF HILL HOSPITAL.

This hospital stands at the southern extremity of the borough of Gateshead (Map I.). It is reached by the Old Durham Road, which passes one side of the site.

The Gateshead Town Council have not obtained the Board's sanction to loan in connection with the provision of this hospital. Part was erected in 1878; other portions have been added in subsequent years. The site is about four acres, and is enclosed by a stone wall surmounted by barbed wire or by broken glass.

The buildings comprise a main block, with an administrative building in the centre and a ward block on each side, a newer three-ward block, a porter's lodge, a building containing a steam disinfecting apparatus, and a mortuary. There is a laundry (which is insufficient and unsatisfactory) behind the administrative building. During the small-pox epidemic a "discharge block" was provided, and quite recently also a galvanised iron building was erected near the entrance to the hospital for the temporary reception of "contacts" while their homes were being disinfected. The ward blocks together contain seven wards, in addition to four single-bed wards. The total accommodation for patients which these wards are designed to provide appears to be about 78 beds. During the epidemic, however, one of the ward blocks was reserved for the temporary reception of "contacts," or for staff purposes and consequently the total accommodation for small-pox cases was reduced to five wards, intended for about 50 beds, together with two single-bed wards. Some of these five wards were unduly crowded at certain periods; on one occasion the hospital contained as many as 76 patients. The staff, in addition to the matron, in May last comprised ten nurses, nine others of the female staff, two porters, and two ambulance men. Dr. Clayton (or his deputy, Dr. Kapp) acted as medical officer to the hospital during the greater portion of the epidemic. Since the beginning of May of this year there has been a resident medical officer. The following Table III. shows the number of cases of small-pox admitted, fortnight by fortnight, during the epidemic: all were cases from the borough of Gateshead. The same figures are exhibited in Diagram II. at the end of this report.

TABLE III.—SHERIFF HILL HOSPITAL: SMALL-POX CASES ADMITTED.

Fortnights Ended.	*Period I.*										*Period II.*					
	26 April, 1903.	*10 May,* "	*24* "	*7 June,* "	*21* "	*5 July,* "	*19* "	*2 Aug.,* "	*16* "	*30* "	*13 Sept.,* "	*27* "	*11 Oct.,* "	*25* "	*8 Nov.,* "	*22* "
Small-pox cases admitted.	4	4	10	8	15	10	7	4	3	2	5	1	7	5	6	3

Fortnights Ended	*Period III.*										*Period IV.*				
	6 Dec., 1903.	*20* "	*3 Jan., 1904.*	*17* "	*31* "	*14 Feb.,* "	*28* "	*13 Mar.,* "	*27* "	*10 April* "	*24* "	*8 May,* "	*22* "	*5 June,* "
Small-pox cases admitted.	27	28	20	35	41	31	34	38	36	34	49	24	7	13

The hospital is about two miles from the Tyne, and a little over two miles from any part of Gateshead. Practically the whole of this borough lies to the north and west of the hospital. To the north and east of it is the urban district of Felling: almost all the inhabitated portion of this district is within two miles of the hospital. To the south, south-west, and south-east of the hospital is a large tract of open country, sparsely populated, which forms part of Chester-le-Street Rural District. Within half a mile of the hospital there are 836 dwellings in Gateshead and 461 dwellings in Felling. If a line be drawn on the map, through the hospital, from W.S.W. to E.N.E., all but six of these 1,297 dwellings lie to the north of it. All the 461 dwellings in Felling are in or near the hamlet of Windy Nook, between ¼ mile and ½ mile from the hospital.

INCIDENCE OF SMALL-POX ON DWELLINGS WITHIN HALF A MILE OF SHERIEF HILL HOSPITAL, AS COMPARED WITH THOSE ELSEWHERE IN GATESHEAD AND FELLING.

The Medical Officers of Health of Gateshead and Felling in each instance supplied me with detailed lists showing, in order of date, all the cases of small-pox which were notified during the epidemic, and all the houses which were affected. In addition they prepared, respectively for Gateshead and Felling, a series of maps which showed, month by month, the position of all dwellings newly invaded by the disease. At my request, also, an actual enumeration was made in each district of the number of dwellings* respectively within ¼ mile and within ½ of the hospital boundary.

* In these enumerations the definition of "dwelling" given above was adhered to. It should be noted that there are no houses within ¼ mile of the hospital of the kind referred to in the footnote on p. 140. On consideration of Tables IV. and VI. (Gateshead) it may be said that for this reason a small error is introduced by comparing actually estimated dwellings in the ¼-mile area with census "tenements" in the rest of the borough. An error in this direction would have the effect of diminishing unduly rates calculated for the "rest of Gateshead." But the error, such as it is, is certainly more than balanced by my having taken as a basis of comparison, in the ¼-mile area, an actual enumeration of dwellings in 1904, and in the rest of Gateshead the census enumeration of 1901. If the new dwellings in the borough which have been erected and have been taken into occupation since 1901 had been reckoned, the rates calculated for the "rest of Gateshead" would have been lower than they appear in Table VI. Similar considerations apply to Felling.

The facts shown by comparison and study of these data, are set out in the following tables :—

TABLE IV.—DWELLINGS INVADED BY SMALL-POX.

GATESHEAD AND FELLING SEPARATELY.

	Gateshead.				Felling.			
	Distant from Hospital.				Distant from Hospital.			
	Under ¼ mile.	*Between ¼ and ½ mile.*	Total under ½ mile.	Rest of Gateshead over ½ mile.	*Under ¼ mile.*	*Between ¼ and ½ mile.*	Total under ½ mile.	Rest of Felling over ½ mile.
Total dwellings	*328*	*508*	836	21,999	*2*	*459*	461	4,211
Dwellings newly invaded by small-pox during — Period I.	*11*	*1*	12	30	—	*1*	1	4
Period II... ..	*0*	*0*	0	19	—	*4*	4	3
Period III. ..	*10*	*2*	12	122	—	*11*	11	30
Period IV. ..	*6*	*7*	13	108	—	*8*	8	45
Whole epidemic	*27*	*10*	37	279	—	*24*	24	82

TABLE V.—DWELLINGS INVADED BY SMALL-POX.

GATESHEAD AND FELLING COMBINED.

	Distant from Hospital.			Rest of Gateshead and Felling over ½ mile.
	Under ¼ mile.	*Between ¼ and ½ mile.*	Total under ½ mile.	
Total dwellings	*330*	*967*	1,297	26,213
Dwellings newly invaded by small-pox during — Period I.	*11*	*2*	13	34
Period II.	*0*	*4*	4	22
Period III.	*10*	*13*	23	152
Period IV.	*6*	*15*	21	153
Whole epidemic ..	*27*	*34*	61	361

TABLE VI.—DWELLINGS INVADED BY SMALL-POX PER 1,000 OF TOTAL DWELLINGS.

GATESHEAD AND FELLING SEPARATELY.

—		Gateshead.				Felling.			
		Distant from Hospital.			Rest of Gateshead over ½ mile.	Distant from Hospital.			Rest of Felling over ½ mile.
		Under ¼ mile.	*Between ¼ and ½ mile.*	Total under ½ mile.		*Under ¼ mile.*	*Between ¼ and ½ mile.*	Total under ½ mile.	
Total dwellings as		*1,000*	*1,000*	1,000	1,000	—	*1,000*	1,000	1,000
Proportion of dwellings newly invaded by small-pox during	Period I.	*33·5*	*8·0*	14·3	1·4	—	*8·8*	2·2	0·9
	Period II... ..	*0·0*	*0·0*	0·0	0·9	—	*8·7*	8·7	0·7
	Period III. ..	*30·5*	*3·9*	14·3	5·5	—	*23·9*	23·9	7·1
	Period IV. ..	*18·8*	*13·8*	15·5	4·9	—	*17·4*	17·4	10·6
	Whole epidemic	*82·8*	*19·7*	44·1	12·7	—	*58·1*	52·1	19·4

TABLE VII.—DWELLINGS INVADED BY SMALL-POX PER 1,000 OF TOTAL DWELLINGS.

GATESHEAD AND FELLING COMBINED.

—		Distant from Hospital.			Rest of Gateshead and Felling over ½ mile.
		Under ¼ mile.	*Between ¼ and ½ mile.*	Total under ½ mile.	
Total dwellings as		*1,000*	*1,000*	1,000	1,000
Proportion of dwellings newly invaded by small-pox during	Period I.	*33·3*	*8·1*	10·0	1·3
	Period II.	*0·0*	*4·1*	3·1	0·8
	Period III.	*30·3*	*13·4*	17·7	5·8
	Period IV.	*18·8*	*15·5*	16·2	5·8
	Whole epidemic ..	*81·8*	*35·2*	47·0	13·7

The above tables show that there has been a notably heavier incidence of small-pox on dwellings within half a mile of the hospital than on those more than half a mile away.

This is apparent (Table VI.) alike when Gateshead is taken by itself and when Felling is taken by itself. When the Gateshead and Felling figures are combined (Table VII.) it is seen that not only was the incidence of small-pox on the ¼ mile area greater than that on the rest of the borough and urban district, but also within the half mile the incidence was at its heaviest in the inhabited areas nearest to the hospital, *i.e.*, that within a quarter of a mile of it. The proportion of dwellings invaded by small-pox during the whole epidemic in the ¼-mile circle, in the ¼ to ½-mile zone, and in the rest of Felling and Gateshead was respectively (omitting decimals) 82, 35, and 14 per thousand.

The observed disproportionate incidence of small-pox on the ½-mile area is not due to the occurrence within that area of an excess of cases during only a single portion of the thirteen months' epidemic. On reference to the figures for the four periods into which these thirteen months are sub-divided, it will be seen that in each period the incidence on the ½ mile circle was greater than that on the rest of Gateshead and Felling. In each period also (except Period II., during which few cases were admitted to the hospital, *see* Table III.) the ¼-mile circle suffered more severely than the ¼ to ½ mile zone, while in each period the latter suffered more severely than the rest of Gateshead and Felling.

The fact that there was an exceptionally heavy incidence of small-pox in the ½-mile area during each of the four periods does not mean, of course, that the excess existed at all times during the epidemic—for example, that it was shown in every fortnight or even in every month. On study of fortnightly returns it appears that, broadly speaking, the excess in the ½ mile area occurred most conspicuously in May and June, 1903 (soon after the hospital had been taken into use for small-pox cases), and in January, March, and April, 1904. The figures with which I am dealing do not go beyond the end of May, 1904, when the epidemic had become reduced to small proportions. But it may be added that in Gateshead a few new cases of small-pox occurred in June, and that there was a slight recrudescence of the epidemic in July, occasioned principally by some undetected cases in the northern part of the borough. A few weeks after this recrudescence small-pox again made its appearance in dwellings within half a mile of the hospital.

In addition to the above comparison between the ½-mile area and the rest of Gateshead and Felling, it seemed desirable to contrast the incidence of small-pox on the ½-mile area with the corresponding incidence of the disease on a series of sub-areas in Gateshead and Felling, situated more than half a mile from the hospital, and containing somewhere about the same number of dwellings as the ½-mile area. With this object I obtained details of the houses newly invaded by small-pox in the several *wards* of each district, during each period of the epidemic. I also obtained estimates, based on the census of 1901, of the total number of dwellings in each ward in that year.* From these

* In the absence of sufficiently complete particulars I have not attempted to bring these estimates down to date. So far as the 1901 figures underestimate the total number of dwellings in the several wards in 1904, they have the effect of increasing the rate of small-pox incidence on the wards, and so of diminishing the contrast between the wards and the ½-mile area. In the latter the total number of dwellings was ascertained by actual enumeration in 1904.

data I have reckoned the proportion of newly invaded dwellings, per 1,000 dwellings, in each of nine wards of Gateshead more than half a mile from the hospital, and in each of three wards of Felling more than half a mile from the hospital,* during each of the four periods, and during the whole epidemic.

The result is shown in Diagram I. and its accompanying table (VIII.), in which are given for comparison the corresponding rates for the ½-mile area, and for the whole of Gateshead and Felling more than half a mile from the hospital. Even when the epidemic is taken period by period there is a noteworthy contrast between the ½-mile area and the several wards. And when the epidemic is taken as a whole, it is seen that there is not one of these twelve wards in which the incidence of small-pox was nearly as severe as in the ½-mile area.

INCIDENCE OF SMALL-POX ON INHABITED AREAS NEAR TO, BUT MORE THAN HALF A MILE FROM, SHERIFF HILL HOSPITAL.

In several epidemics where it has been possible to made careful study of the incidence of small-pox on inhabited areas in the neighbourhood of a hospital receiving acute small-pox cases, unmistakable evidence has been obtained that the influence of the hospital (in originating, enhancing, or maintaining the spread of the disease) has been exercised on localities more than half a mile away; such influence has for example been shown in areas distant from half to one mile from the hospital. In the present instance, looking to the obvious indications that hospital influence was responsible for a material portion of the small-pox which occurred within half a mile of Sheriff Hill hospital, it would be interesting to carry the inquiry further: for example, with a view to seeing whether, in the matter of intensity of small-pox incidence, the inhabited area between half a mile and one mile from the hospital stood midway between the ½-mile area on the one hand and the rest of Gateshead and Felling, more than a mile from the hospital, on the other.

I am not, however, in position to make this further comparison. When I visited Gateshead and Felling my intention was merely to obtain sufficient facts to indicate whether hospital influence had or had not been exerted; and on reviewing the local circumstances it seemed enough for this purpose to limit my statistical inquiries to the ½-mile area, with the advantage of greatly lessening the work of the officials of the local authorities in enumerating dwellings. If in view of the facts brought together in this report a further local enumeration of dwellings, say in different areas between half a mile and one mile from the hospital, were now made, instructive results should be obtained.

In the absence of statistics, however, I may note two circumstances which suggest that hospital influence has been responsible

* The South Ward of Gateshead and the South Ward of Felling together include so much of the ½-mile area as is contained in these districts. The figures for these wards are given in Table VIII., which accompanies Diagram I., but are not exhibited in the diagram itself.

for some portion of the small-pox in dwellings over half a mile from the hospital. The first is that in Gateshead, the ward which (setting aside the South ward, comprising the whole of the Gateshead area within half a mile of hospital) suffered most severely was the East ward—*see* Diagram I. and Table VIII., and also Map I. This ward contains more dwellings within a mile of the hospital than any other (save the South). The second is that in Felling there appears to have been an exceptional incidence of small-pox in Caldwell Lane and High Felling, between half and one mile from the hospital. The Medical Officer of Health, in his report written in May, points out that "37 cases of small-pox in our district occurred within 1,000 yards of the Gateshead small-pox hospital, and 101 cases out of a total 146 cases occurred within a mile of the said hospital."

The probable occurrence of spread of small-pox due to hospital influence in areas *more than half a mile* from the hospital should not be forgotten in considering the contrast above exhibited between the incidence of small-pox respectively on the ½-mile area and that on the "rest of Gateshead and Felling over half a mile from the hospital." By how much the spread of small-pox in the latter area has been related to hospital influence, by so much has the proportion of dwellings invaded in that area been made higher. It must not be supposed therefore that the differences between the figures and rates for these two areas afford an index of the magnitude or extent of the influence of Sheriff Hill hospital in this epidemic.

CAUSES OF SPREAD OF SMALL-POX, OTHER THAN AERIAL CONVECTION, IN RELATION TO THE EXCEPTIONAL INCIDENCE OF THE DISEASE ON DWELLINGS NEAR SHERIFF HILL HOSPITAL.

The ½-mile area comprises, in Gateshead, the neighbourhoods of Sodhouse Bank, Blue Quarries, and part of Low Fell; and, in Felling, the village of Windy Nook. In relation to these localities I inquired as to the following:—

Vaccination and other preventive measures.—Alike in the borough and in the urban district the preventive measures adopted were the same whether the dwellings invaded were within or without the ½-mile area. As a result of the exceptional prevalence of small-pox within the ½-mile area as the epidemic progressed, the proportion of persons who were vaccinated or re-vaccinated and so obtained protection against small-pox attack, seems on the whole to have been greater within the ½-mile area than elsewhere in Gateshead and Felling.

Opportunities of infection due to personal relations with the hospital, hospital patients, or hospital staff.—On one occasion a delirious small-pox patient escaped from the hospital for a short time, but no persons seem to have been infected as a result of this accident. Certain instances occurred in which persons attempted to communicate with patients over the wall of the hospital grounds. Whether any of these persons contracted small-pox in

consequence of their proximity to the hospital on these occasions cannot be said with certainty: no instance of the kind was traced. There is no evidence that the people in question lived in the ½-mile area. Visitors were practically excluded altogether from the hospital grounds; persons needing information about patients in the hospital obtained it at the offices of the health department in Gateshead, which is connected to the hospital by telephone. The matron of the hospital, Miss Barnes, from her previous experience was well acquainted with small-pox hospital administration and with necessary measures of precaution at a small-pox hospital, and these were strongly insisted upon by the Borough Medical Officer of Health. Rules for the staff as to changing clothing, hair washing, and disinfection before leaving the hospital were strict, and seem to have been well enforced. I could hear of no instance in which small-pox infection was suspected to have been conveyed by any members of the staff. It did not appear that nurses or others of the resident staff were in the habit of visiting houses in the ½-mile area in Gateshead, still less Windy Nook in Felling, or had any occasion to do so. There are scarcely any shops in the ½-mile area, while access to the lower part of Gateshead and to Newcastle is easy, as there is a service of electric cars along the Old Durham Road from Sheriff Hill to Gateshead station and the Tyne bridge.

The traffic of tradesmen to and from the hospital is mainly from shops or stores in the lower and northern part of Gateshead, more than a mile away. Dr. Clayton was satisfied that no infection in the ½-mile area had been conveyed by ambulances or carts going to and from the hospital. Sodhouse Bank, which is part of the Old Durham Road, is on the main line of such traffic; the neighbourhoods of Low Fell and Blue Quarries are not on the line of traffic to or from the hospital. In Felling, the inhabitants of Windy Nook seldom have occasion to come up hill into the part of the Old Durham Road near the hospital; their usual way into Felling, Gateshead, or Newcastle is by roads down hill to the north or west. In his report on this subject Dr. Peacock states his opinion that the personal carriage of infection from the hospital to Windy Nook can be left out of the question.

Other exceptional opportunities of personal infection.—In Gateshead, towards the end of November, 1903, an unrecognised case of small-pox—a youth going about his ordinary business for some weeks while suffering from a mild form of the disease—started a series of cases in a considerable number of dwellings in the east central, east, and south central wards of the borough. This series in fact (beginning of Period III.) was preliminary to a general increase in small-pox throughout the whole of Gateshead, and, later on, to a renewed increase of small-pox in the ½-mile area round the hospital. In Felling, in April, 1904, a series of cases in several different dwellings in Bill Quay, in the east ward, arose as the result of certain persons remaining at home when suffering from small-pox, unknown to the officers of the sanitary authority. In addition to these occurrences I heard of instances of smaller groups of cases associated with the late detection of an antecedent small-pox case. I therefore endeavoured to

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ascertain whether similar occurrences had been traced within the ½-mile area during any period of the epidemic. I found that what may be termed "connected" cases had occurred in the ½-mile area, as elsewhere in the two districts. Thus, on several occasions the first case in a dwelling was followed by other cases in the same dwelling. In certain instances the first case in a newly invaded dwelling had had opportunities of personal infection from a case of small-pox a fortnight before his illness. In a few others the first case in a dwelling was a person already known as a "contact" of an antecedent case, and was accordingly being kept under medical observation at the time when his attack began. In the Gateshead portion of the ½-mile area three instances occurred in which cases of small-pox were not detected for a few days, and which were ascertained to have infected persons living at other houses. But, looking at the facts as a whole, there seemed nothing to show that the explanation of the excessive and sustained incidence of small-pox on dwellings in the ½-mile area, whether compared with the rest of Gateshead and Felling or with any of the ward sub-areas of those districts, was the presence and persistence of peculiarly numerous opportunities of personal infection within the ½-mile area.

Dr. Peacock, dealing in his report with the Felling outbreak, says in regard of that district: "In a great many cases the source of infection has been discoverable, but there still remains a large number of cases (viz., 65) in which no history of contact with anyone suffering from the disease can be traced. A great number of these cases are in the Windy Nook district. . . . ."

Aerial convection in relation to the exceptional incidence of small-pox on dwellings near Sheriff Hill Hospital.

Aerial convection affords the probable explanation of the persistent and exceptional incidence of small-pox in the neighbourhood of this hospital, and of the graduation in the intensity of incidence from centre to periphery which appears when the ½-mile area is compared with the rest of the ½-mile area (Table VII.). The facts can readily be accounted for if, on particular occasions during the epidemic, in suitable atmospheric conditions, infection was carried aerially from the hospital to one or another part of the inhabited area in its vicinity.

On this view, it deserves to be noted that Sheriff Hill hospital stands well above the whole of Gateshead and Felling, its elevation being some 520 feet above the Tyne. Calm foggy days and nights—conditions which have been suspected to favour aerial convection in the case of London small-pox hospitals near the Thames—are here comparatively rare. From study of wind records which Messrs. Brady and Martin were good enough to put at my disposal, I found that at their observation station in a high part of Newcastle, some 220 feet above the Tyne, "calm" was reported on 46 mornings between 1st April, 1903, and

* Mornings when there was practically no wind, *i.e.*, "Calm" (Beaufort's Scale): 1903—April, 3 mornings; May, 1; June, 2; July, 2; August, 1; September, 5; October, 6; November, 4; December, 11. 1904—January, 5; February, 2; March, 2; April, 2 mornings.

ADDITIONAL NOTE AS TO FELLING SMALL-POX HOSPITAL.

All cases of small-pox which occurred in the Urban District of Felling were isolated in a temporary* hospital building off Stonygate Lane, in the North ward of Felling. The number of acute cases under treatment at this hospital did not at any time approach the corresponding number in Sheriff Hill (*cf.* Diagram II.). During the first two periods of the epidemic (Periods I. and II., seven and a half months to the end of November, 1903) the total number of cases isolated at Felling hospital was 20 only. During the two subsequent periods (Periods III. and IV., December, 1903, to May, 1904) the number of acute cases under treatment was occasionally considerable. In two of the fortnights shown in Diagram II. the number of cases admitted was as high as 22 (fortnight ended February 28th) and 26 (fortnight ended April 24th). Inquiry seemed desirable therefore for evidence of exceptional incidence of small-pox around this hospital during these Periods III. and IV. of the epidemic.

There are fewer dwellings within a quarter of a mile of Felling Hospital than within the same distance of Sheriff Hill hospital (227 as against 330). Of these 227 dwellings, nine were invaded by small-pox during these two periods; one other had been invaded in November (Period II.).

The inhabited area within half a mile of Felling hospital comprises the larger part of the North ward of Felling, a small corner of the Central ward, and Nether Heworth and part of Bill Quay in the East ward. I have no figures, from actual enumeration, of the total dwellings within half a mile, and comparison of the incidence of small-pox on this ½-mile area with that on other parts of Felling would, in any case, be difficult. Two wards in Felling are more than half a mile from Felling hospital—the South, and (practically the whole of) the Central. But the greater part of the South ward is from a quarter to three quarters of a mile, and most of the Central ward is within one mile, of Sheriff Hill hospital, After studying, however, with Dr. Peacock's assistance, such data as were available, they did not appear to me to afford any *prima facie* evidence of exceptional spread of small-pox, attributable to hospital influence, in this ½-mile area during the two periods in question.

In connection with the apparent absence of evidence that aerial convection had been operative round Felling hospital during the periods in question, the following points in respect of which the conditions at the Felling establishment differed from those at Sheriff Hill deserve mention :—

(1.) A large proportion of the dwellings within half a mile of Felling hospital (and especially those within a quarter of a mile) lie in deep narrow gullies which traverse

* By a recent Order, Felling has now been combined with certain neighbouring districts (Hebburn, Jarrow, and Southwick U.D.'s and Sunderland and South Shields R.D.'s) for the purpose of making joint provision for isolation of small-pox cases. Felling has its own hospital at Windy Nook for infectious diseases other than small-pox. This hospital has recently been erected and completed, but Dr. Peacock has advised (rightly, in my opinion) that it should not be opened for patients whilst acute cases of small-pox are being treated at Sheriff Hill hospital, just a quarter of a mile aw-

the low plateau on which the hospital stands. These gullies are partly natural, of the kind familiar to those acquainted with this part of Tyneside, and partly they have been formed by the accumulation of large masses of old alkali waste. The air in these gullies is almost always stagnant, and the houses in them are well screened from any light winds blowing from the direction of the hospital. Similar considerations apply to other dwellings, situated on the bank of the Tyne and below the abrupt edge of the plateau in question.

(2.) Light winds from the south and south-west, which appear to have favoured aerial convection round Sheriff Hill hospital, would carry any infected air rising from the wards of Felling hospital across the Tyne, clear of any considerable inhabited area in Felling. On the other side of the Tyne, north and north-east from the hospital, and within half a mile of it, there are few inhabited houses.

(3.) It was the custom in Felling hospital to use as a matter of routine in the treatment of all cases of small-pox an abundance of carbolic oil, which was applied all over the body surface. At Sheriff Hill hospital oily preparations were used in certain cases only, and their application was commonly restricted to face and hands. The difference in the practice of the two hospitals in this respect is worth recording, in view of evidence lately adduced by Dr. Niven, that systematic treatment of small-pox patients by oiling may diminish risk of aerial convection of small-pox infection.

NOTES AS TO MAPS AND DIAGRAMS.

MAP. I. is reduced from the Ordnance Survey 6-inch to the mile maps. These maps were revised after re-survey in 1894-5. The principal area which has been built over since the re survey is the West ward of Gateshead (neighbourhood of Saltwell Park). The number of dwellings erected since the re-survey within half a mile of Sheriff Hill hospital is comparatively small.

The red lines showing ¼- and ½-mile distances from the hospital have in each instance been taken from the hospital boundary. The blue lines show the boundaries of the present wards of Gateshead and Felling in 1904.

MAP II. is based on a 6-inch-to-the-mile map prepared by the Borough Surveyor of Gateshead.

The coloured dots represent houses newly invaded by small-pox during—

Period	I.—	Green dots.
„	II.—	Brown „
„	III.—	Red „
„	IV.—	Blue „

DIAGRAM I. shows the proportion of dwellings newly invaded by small-pox (during each of the four periods and during the whole epidemic) in the nine wards of Gateshead and the three wards of Felling which in their inhabited parts are everywhere more than half a mile from Sheriff Hill hospital; in the area within half a mile of Sheriff Hill hospital; and in the whole of Gateshead and Felling more than half a mile from the hospital. The rates shown in the diagram are per 1,000 dwellings in each instance. They have been calculated from the following data (Table VIII.):—

TABLE VIII.

—	Total Dwellings.	Dwellings newly invaded by Small-pox during:—					Total Dwellings.	Dwellings newly invaded by Small-pox per 1,000 dwellings during:—					—
		Period I.	Period II.	Period III.	Period IV.	Whole Epidemic.		Period I.	Period II.	Period III.	Period IV.	Whole Epidemic.	
NINE GATESHEAD WARDS.													
North-west	2,845	—	1	3	21	25	*1,000*	—	*0·4*	*1·1*	*7·4*	*8·8*	N.W.
West Central	2,255	2	1	8	4	15	*1,000*	*0·9*	*0·4*	*3·5*	*1·8*	*6·7*	W.C.
West	1,770	2	—	7	10	19	*1,000*	*1·1*	—	*4·0*	*5·6*	*10·7*	W.
North	2,470	2	2	12	8	24	*1,000*	*0·8*	*0·8*	*4·9*	*3·2*	*9·7*	N.
Central	2,350	2	—	10	10	22	*1,000*	*0·8*	—	*4·3*	*4·3*	*9·4*	C.
South Central	2,080	—	1	15	7	23	*1,000*	—	*0·5*	*7·2*	*3·4*	*11·1*	S.C.
North-east	2,615	14	5	11	9	39	*1,000*	*5·3*	*1·9*	*4·1*	*3·4*	*14·7*	N.E.
East Central	2,535	2	3	26	11	42	*1,000*	*0·8*	*1·2*	*10·3*	*4·3*	*16·6*	E.C.
East..	2,315	3	7	27	21	58	*1,000*	*1·3*	*3·0*	*11·7*	*9·1*	*25·1*	E.
THREE FELLING WARDS.													
Central	1,510	4	—	12	15	31	*1,000*	*2·6*	—	*7·9*	*9·9*	*20·5*	C.
North	760	—	—	3	11	14	*1,000*	—	—	*3·9*	*14·5*	*18·4*	N.
East..	1,285	—	2	3	12	17	*1,000*	—	*1·6*	*2·3*	*9·3*	*13·2*	E.
AREA WITHIN ½ MILE OF SHERIFF HILL HOSPITAL.	1,297	13	4	23	21	61	*1,000*	*10·0*	*3·1*	*17·7*	*16·2*	*47·0*	½
GATESHEAD AND FELLING WARDS, PARTS OF WHICH ARE WITHIN ½ MILE OF SHERIFF HILL HOSPITAL.*													
Gateshead, South	1,570	14	—	14	21	49	*1,000*	*8·9*	—	*8·9*	*13·4*	*31·2*	G.S.
Felling, South	1,120	1	5	22	16	44	*1,000*	*0·9*	*4·5*	*19·6*	*14·3*	*39·3*	F.S.

* The rates for these two wards are not shown in Diagram I.

4.

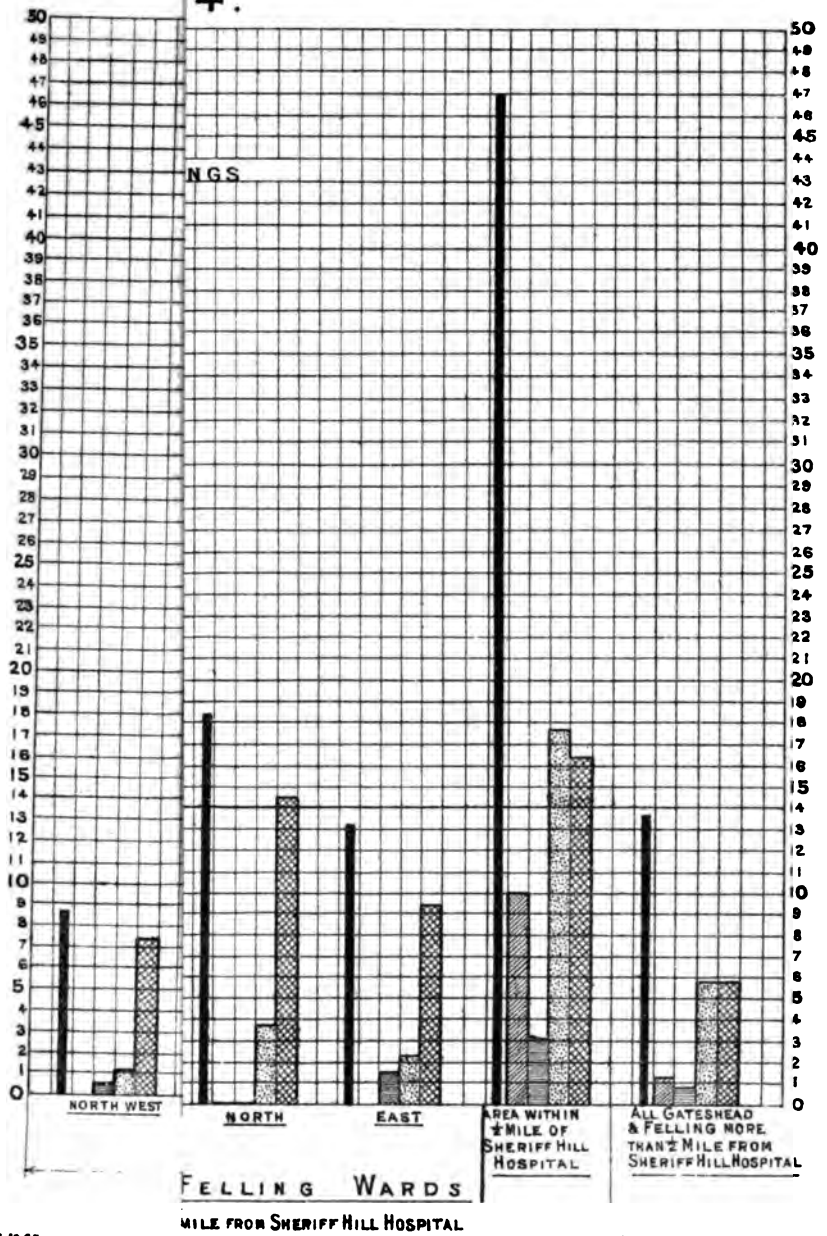

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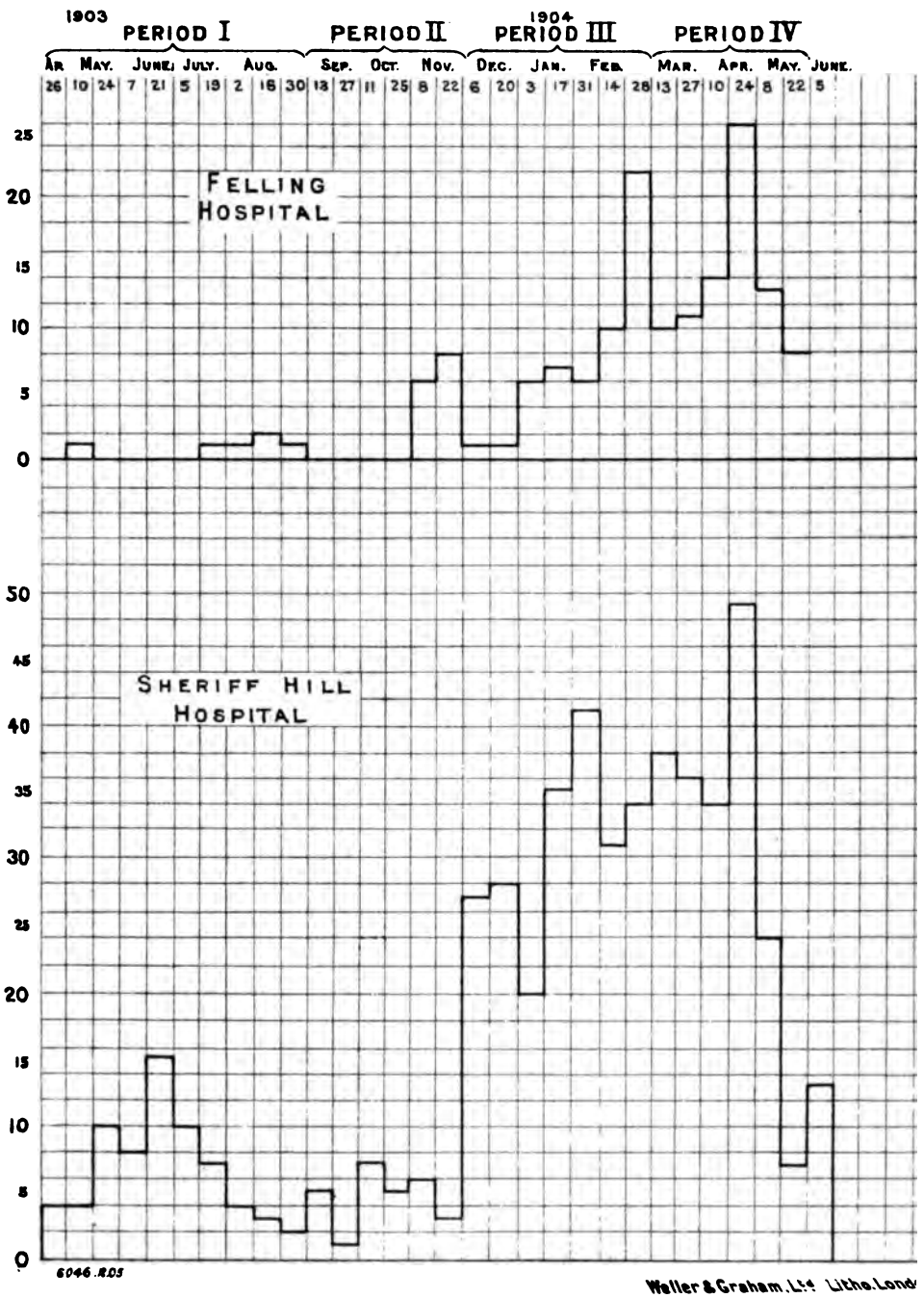
DIAGRAM II.

SMALLPOX CASES ADMITTED TO HOSPITAL IN FORTNIGHTS ENDED.


1903
PERIOD I
PERIOD II
1904
PERIOD III
PERIOD IV
APR. MAY. JUNE. JULY. AUG. SEP. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY. JUNE.
26 10 24 7 21 5 19 2 16 30 13 27 11 25 8 22 6 20 3 17 31 14 28 13 27 10 24 8 22 5
FELLING HOSPITAL
0 5 10 15 20 25
SHERIFF HILL HOSPITAL
0 5 10 15 20 25 30 35 40 45 50
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No. 10.

REPORT on SMALLPOX and SMALLPOX HOSPITALS at LIVERPOOL, 1902-1903; by Dr. Reece.

With reference to the behaviour of smallpox in the City of Liverpool during the years 1902 and 1903, and to the report thereon by Dr. Hope, the Medical Officer of Health for Liverpool, the Local Government Board, on 10th March of this year (1904), notified the Town Council that I had been instructed to visit the City, and to make detailed investigation of certain aspects of the outbreak respecting which the Board desired information. The Town Council were requested to be so good as to direct their officers to afford me all necessary assistance in the prosecution of my inquiry. I visited Liverpool on 14th March, and on many subsequent dates, and during my inquiry into the prevalence of smallpox in the City I received at all hands cordial co-operation and assistance, not only from the officers of the Town Council, but also from officers of H.M. Customs, the medical officer of the Prison, Poor Law officials, as well as from other and private persons of whom I sought information.

I have the honour to report as follows :—

The City of Liverpool, which now includes the Urban District of Garston, occupies some 23 square miles of the Lancashire shore of the River Mersey. Northwards it extends to and partially envelops the Borough of Bootle; elsewhere it is (passing from north to south) contiguous to Sefton Rural, to Huyton with Roby, Childwall, Little Walton, and Allerton Urban Districts, and to the Whiston Rural District. It measures about nine miles in length between its extreme points, and at its greatest width it is about five miles.

The Rateable Value of the City exceeds £4,000,000.

The following table, Table I., gives the area of the City, the number of houses and the population at the Census of 1901. Since that Census, the Urban District of Garston has been incorporated with Liverpool, and 1,673 acres (excluding half the bed of the river) and about 5,800 houses have been thus added to the City. The population of Garston at the time of incorporation in 1902 was estimated at 17,300 persons. The table also shows the acreage, and the number of houses and the population of the extended City as estimated by the City Engineer.

TABLE I., showing the Area in Acres, the Number of Inhabited and Uninhabited Houses, and of Houses building, in the City of Liverpool at the Census 1901; with like data for the Extended City, including Garston, as at present estimated.

City of Liverpool.	1901 Census.	1904. (Including Garston.)	
Area in acres (excluding half bed of River)	13,236	14,909	
Number of inhabited houses	123,469	129,200	Estimated.
Number of uninhabited houses in occupation ...	6,752	7,000	Estimated.
Number of uninhabited houses not in occupation ...	4,328	4,500	Estimated.
Number of houses building	920	1,000	Estimated.
Population	685,276	723,430	Estimated.

Liverpool as a seaport town, attracting as it does a large number of persons of the working and vagrant classes from a great variety of sources at home and abroad, has been especially prone to receive smallpox, and to a corresponding extent has had abundant opportunities of perfecting its administration in regard of this disease.

In the dozen years preceding the epidemic of 1902–3 the number of cases of smallpox notified or discovered in Liverpool year by year was as follows:—*

Year.	Number.	Year.	Number.
1890	2	1896	8
1891	21	1897	6
1892	177	1898	17
1893	75	1899	10
1894	229	1900	156
1895	130	1901	37

* Figures taken from the Annual Reports of the Medical Officer of Health.

Towards the end of the year 1901 there was practically no smallpox in Liverpool, but in the month of December smallpox was introduced to the City by way of the Port.

At this time there was smallpox in Boston, U.S.A., from which place cattle ships trade regularly to Liverpool. Many of the cattlemen of these ships are not regularly employed by the shipowners, and do not go back to America with the cattle ships on their return voyage. These men are furnished with return tickets, which they often sell in Liverpool, and then either work their passage back or join the loafers and tramp class in Liverpool. Men of this class contributed several of the "imported" cases of smallpox with which Liverpool had to deal in the year 1902. They introduced smallpox to several common lodging houses, and to certain streets in the poorer parts of the town, and to their agency the introduction of smallpox at the end of the year 1901 is in great measure due, though not entirely, as the disease was also carried to the town by tramps.

There are nearly 500 common lodging houses in the City, and during the two years now in question smallpox occurred in just over 10 per cent. of them.

In consequence of the excellent administrative arrangements of the Health Department of Liverpool, smallpox made little headway until the month of November, 1902, when as a result of a case of concealed, or unnotified, or not discovered, smallpox in Robsart Street, in a poor part of the town, a local outburst occurred. Though prompt measures were taken by the Sanitary Authority these failed to control this outbreak, and cases continued to occur in increasing numbers late in 1902, and at the beginning of the year 1903 smallpox assumed the proportions of a considerable epidemic. It remained on this scale until the end of June 1903, when it began to subside, and finally by the end of the year 1903, smallpox had disappeared from Liverpool. Altogether, from 6th December, 1901, to the end of 1902 some 552 cases of smallpox were known to have occurred. From the beginning of 1903 to the end of June the corresponding figure is 1,585, and for the last six months of that year, 141. These figures do not include some 33 cases found on vessels on their arrival in Liverpool, though the cases from the shipping which were removed to hospital from houses in the City have been counted.

As soon as a case of small-pox is notified to the Medical Officer of Health, on the proper notification form, or by telephone, or verbally, the Medical Officer of Health, Dr. Hope, occasionally, or the Assistant Medical Officer of Health, Dr. Mussen, generally, visits the patient to confirm the diagnosis. Not all cases are thus visited, as from previous experience it is known that many of the medical practitioners of Liverpool are well acquainted with smallpox, but in all instances where the case is of doubtful nature, or one on which the opinion of the Medical Officer of Health is requested, visit is promptly made. Dr. Nathaniel E. Roberts, who is physician to two of the City smallpox hospitals, also shares this duty when the cases to be visited are numerous. Without waiting for the result of the diagnosis of the expert officer, the ambulance department, which is under the control of a special officer, is communicated with and the smallpox ambulance is sent at once to the infected house. During the epidemic four smallpox ambulances were in use, and as the City

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possesses 12 ambulances at its fever hospitals, more ambulances could have been used if there had been occasion. Those cases notified up to 11 o'clock at night are removed the same day and usually within an hour of notification. Following up the ambulance, and starting immediately after it, is the "bedding van," which removes all infected clothes, bedding, &c., to the disinfecting station. Special vans, of which there were four employed solely for dealing with the smallpox cases, are used, and the infected clothes, &c., are mostly taken to one disinfecting station, that in Charters Street. After disinfection the disinfected articles are returned in furniture vans, which are only used for this purpose. Infected bedding from the poorer houses is rarely disinfected. It is usually very dirty and soiled, and it is disposed of in the refuse destructor at Chiswell Hill, adjoining the Charters Street disinfecting station, and is replaced by new mattresses, &c., of which the Corporation keeps a supply at their depôt.

After the van for removing the clothes, follows the "stoving cart," with its staff of men trained in disinfection of premises. There were four such carts, and at one time 42 men were employed for this smallpox work. These men start the disinfection of the premises at once by burning sulphur in the smallpox infected dwellings. When the house has been under sulphur fumigation for about five hours, the staff returns and strips the paper from the walls, and sprays the interior of the house with a solution of perchloride of mercury. If objection to the Corporation doing this is taken, notice is served on the occupier to do it himself. The paper which has been stripped from the walls is placed in canvas bags, removed to the refuse destructor and burnt in the bags. All cases notified up to 5 p.m. are dealt with so far as the sulphur fumigation is concerned on the day of notification. As many as 34 houses have been dealt with in one day. The men engaged in this work wear overalls, and the Inspectors have two suits of uniform. When occasion required an increase of the staff, the additional men were, as far as practicable, selected from the patients who had had smallpox.

The circumstances of persons attacked by smallpox necessarily vary; but arrangements exist at Liverpool for dealing with all conditions likely to be met with, from the many-roomed house of the well-to-do classes, to the family in a single room, inclusive of the contact with but a single suit of clothes.

The drivers of the ambulances are in the pay of the Corporation, and all the horses used for the ambulances and vans are the property of the Corporation. The number of horses averages under ordinary circumstances about 20, but during the epidemic this number was increased to nearly 40.

As a general rule no nurse travels to Hospital with the patient, although an Inspector may do so; as will presently be noted, there is frequently some other member of the infected household in the ambulance on the journey to the hospital.

Whenever smallpox appears in Liverpool, an Inspector, Mr. Gleaves, who has had considerable experience of this disease, is specially deputed to deal with the cases. He follows the

ambulance and makes inquiries as to possible sources of infection, a duty which in diseases other than smallpox is left to the District Inspectors. Mr. Gleaves had, during the outbreak, a staff of some 18 Inspectors to assist him in this work, and for keeping under supervision such contacts as were not removed to the hospitals. Supervision of these persons was continued for 14 days after each case of smallpox occurred, and any sickness among the contacts was at once reported to the Assistant Medical Officer of Health. Information acquired by these Inspectors was written in note-books, each Inspector having two such books, which he used alternately, one book being left daily in the office of the Medical Officer of Health. The books left were copied and were read next day to the Assembled Inspectors, and each took down particulars of contacts resident in his district, and these he visited for the customary 14 days. The inquiries of these Inspectors included the state of vaccination of the contacts, and information as to this was posted to the various Vaccination Officers directly from the office of the Medical Officer of Health. Similar information was transmitted at once by telephone to the Public Vaccinators.

The compulsory notification of chickenpox which was adopted as a temporary measure on 9th April, 1902, became "permanent" in both the City and the Port Sanitary District on 1st August, 1902.

At the commencement of the recent smallpox outbreak, before the disease assumed epidemic proportions, contacts, as far as they could be induced to go (and they rarely refused), were taken to the smallpox hospitals for isolation and observation. As many as possible were removed in the ambulance along with the smallpox patient, and if the number exceeded that which could be carried in the ambulance a second vehicle was employed. On arrival at the hospital all contacts were vaccinated if this had not been done before removal. They were kept in wards separate from the smallpox patients until the incubation period had passed and their vaccination had proved successful, or until they developed smallpox. They were transferred from one to another hospital, including New Ferry Hospital, as occasion required.

In dealing with infected common lodging houses the procedure varied. Some of these houses are of large size accommodating upwards of 100 lodgers. At first the lodgers were paid at the rate of £1 a week each to submit to vaccination and to remain during that time in the house, and one keeper of an infected lodging house was paid for not taking in any more lodgers during the two weeks following attacks of his lodgers. Later the practice of paying lodgers to stay within doors was abandoned; instead half-a-crown was paid to each lodger accepting vaccination, a sum which ultimately was reduced to one shilling.

No list had been kept in the office of the Medical Officer of Health of the number of contacts placed under observation during the epidemic, or of the number removed to the various hospitals, and no such list could be compiled for me. The total figure must be a very large one.

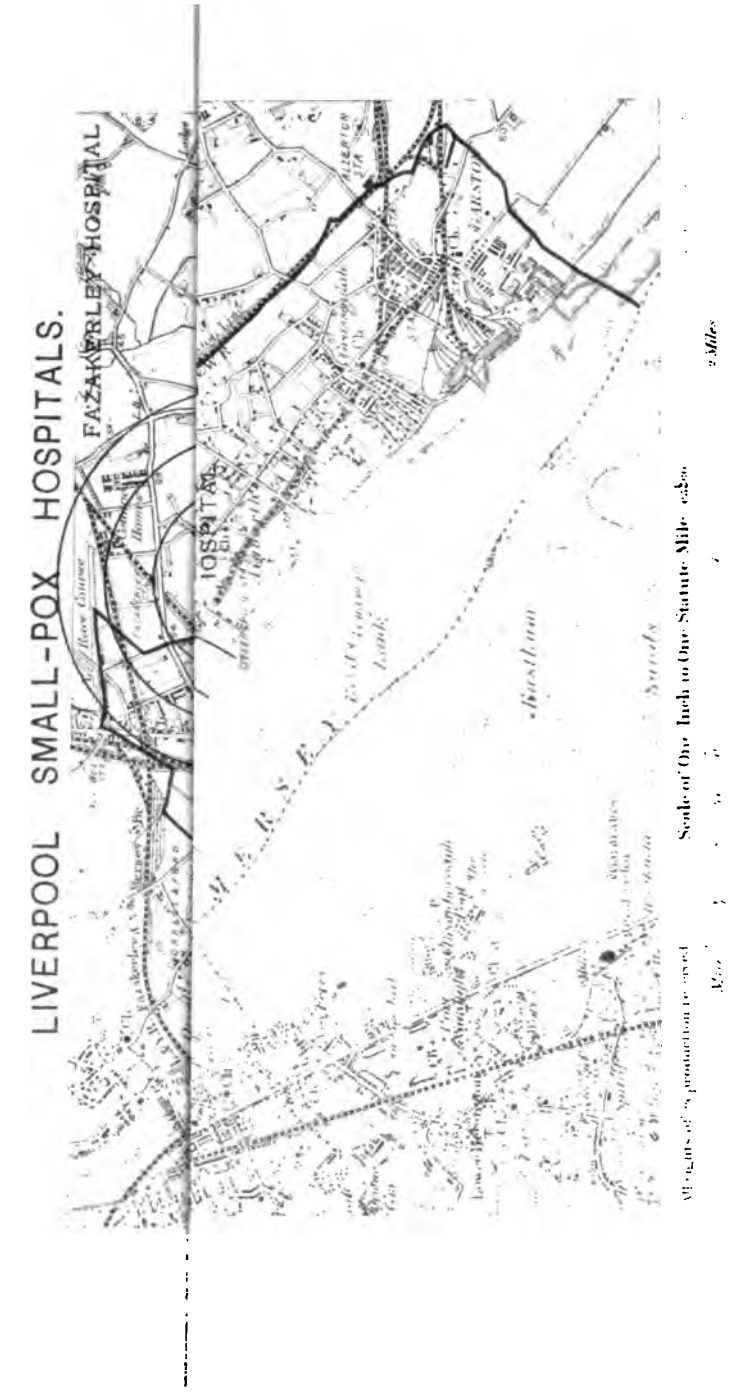
Letters were sent to employers of labour notifying each case of smallpox among their workpeople, and of the contacts employed by them; a list of the Public Vaccinators together with their addresses, and information concerning public vaccination accompanied this notice. A similar notice was sent to the heads of schools in reference to scholars in relation with smallpox.

Throughout the epidemic the Public Vaccinators and the Vaccination Officers of the several Poor Law Unions which are wholly or in part comprised within the City of Liverpool worked in cordial co-operation with the staff of the Sanitary Authority, promptly visiting the invaded houses, and offering or urging vaccination. As the epidemic grew, the Corporation arranged with certain medical men, seven being the greatest number at one time engaged, to visit infected houses on receipt of notice from the Medical Officer of Health, and to offer free vaccination to all therein who would accept it. The medical practitioners thus employed found by experience that they could get but few persons vaccinated when they went alone to the invaded houses, but that on the contrary when they were accompanied by the City Inspectors of Nuisances they rarely met with a refusal. The plan adopted was to visit the infected house, generally in the evening after the working hours of the day, when the entire family was more often found at home. House to house visits were also made by them in the neighbourhood of the dwelling in which smallpox occurred. These gentlemen revaccinated children who had been vaccinated in infancy and who were under 10 years of age. Practically any child over four years of age was revaccinated if found in a house invaded by smallpox, and even younger children were revaccinated if their marks of primary vaccination were indistinct or if there was only one mark of primary vaccination visible. The persons thus vaccinated or revaccinated were visited the following week and the result of the vaccination ascertained. Arrangements were also made with Dr. Arkle, the Medical Officer of the Belmont Road Workhouse, to vaccinate the tramps at the Belmont Road Test House. The Corporation paid for vaccination work in the year 1902, £587 14*s.* 0*d.*, and in the year 1903, £130 16*s.* 0*d.*, a total of £718 10*s.* 0*d.* for the two years.

There can be no doubt that the prompt offer of vaccination and revaccination to contacts and to those living in houses adjacent to the infected dwellings, along with almost universal acceptance of such offer by these people, very materially limited the amount of smallpox in Liverpool.

There are four hospitals belonging to the Corporation which were in 1902–03 used for the reception of smallpox patients.* Of these one is the New Ferry Hospital, which is primarily the hospital of the Port Sanitary Authority: it is situated on the opposite bank of the River Mersey to that on which the City of

* The City of Liverpool by arrangement receives into its smallpox hospitals patients from the Waterloo and Seaforth Urban District, as well as from the Sefton Rural District in which the hospital at Fazakerley is situate. The total number of outside cases thus received between December 1901 and December 1903 was 39. Three cases of smallpox from the shipping were treated in the hospital of the Borough of Bootle.



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of a mile from the smallpox hospital. There are at Fazakerley 160 beds for smallpox patients.

The Medical Officer of Health has no direct administrative control over the various City hospitals. They are managed by a

* Neither Priory Road nor Park Hill Hospital was provided by means of loan sanctioned by the Board.

Liverpool stands. To this hospital were removed a few cases of smallpox from the shipping, and as well certain contacts for observation, and some convalescent patients from the other hospitals, as the necessity for making room in them for fresh cases occurred.

The other three hospitals in use were :

The Priory Road Hospital,
The Park Hill Hospital, and
The Fazakerley Hospital.

The positions of these three hospitals can be seen from the map of Liverpool which accompanies this Report.

The Priory Road Hospital passed into the possession of the Corporation of Liverpool about the year 1895, at a time when the City extended its boundary. This hospital in several respects falls short of modern requirements. Apart from any question of its use for smallpox, the hospital in the matter of structure and arrangement is not one which comes up to the standards recommended by the Board for new hospitals erected under their sanction.* It is regarded as having accommodation for 40 patients. This is the hospital in which, under ordinary circumstances, cases of smallpox occurring in the City of Liverpool have been received for treatment.

The Park Hill Hospital is, under ordinary conditions, used as a fever hospital ; but when the cases of smallpox became numerous in the town, it was taken into use for smallpox patients. This hospital stands on land leased from the Mersey Dock and Harbour Board and which may at some future time be required for dock extension. The knowledge of this fact has largely determined the type of building on the site. The administration block is an old mansion to which wings of a temporary character have been added, and the ward pavilions, though roofed in slate are also of the "temporary type." These have accommodation for 350 beds.

The Fazakerley Hospital stands on land outside the City boundary. At the instance of the Corporation, the Local Government Board held a local inquiry and sanctioned a loan for its erection. The ground purchased was a private estate on which stood a large house, since added to and converted into an administration block. Under pressure of circumstances the pavilions were not built in accordance with the plans submitted at the inquiry ; for example, the walls of certain of the ward blocks are of a temporary character in order to facilitate rapid building. A fever hospital is in the course of erection on a part of the estate which was purchased, but at a distance of a quarter of a mile from the smallpox hospital. There are at Fazakerley 160 beds for smallpox patients.

The Medical Officer of Health has no direct administrative control over the various City hospitals. They are managed by a

* Neither Priory Road nor Park Hill Hospital was provided by means of loan sanctioned by the Board.

hospital committee of the Corporation, to the meetings of which the Medical Officer of Health may be summoned.

Mr. Robert S. Archer, M.D., is physician to the Priory Road Hospital, and he is non-resident. There is no resident medical officer, and the internal arrangements are controlled to a certain extent by the matron. At Park Hill Hospital the visiting physician is Mr. Nathaniel E. Roberts, M.B., and there are one or more resident medical officers according to the number of cases under treatment. Dr. Nathaniel E. Roberts also holds the appointment of consulting physician to the Fazakerley Hospital, and, so far as this hospital is concerned, he is paid by fee for visits made. He visits when he thinks it necessary or when he is specially summoned. There are at Fazakerley one or more resident medical officers according to the number of the patients under treatment. These resident medical officers rarely stay more than six months or a year at a hospital; having acquired experience they seek other appointments or a different kind of work. Hence it follows that of those medical officers holding resident appointments at the hospitals at the time of my visit there were only two who had been in office during the smallpox epidemic of 1902–3, and neither of them had been in office throughout the whole period. The keeping of the several hospital registers and books as well as other administrative duties are entrusted to the resident medical officers, who may have had no previous experience of such work, and whose stay in the hospital is often brief. The drawbacks inevitably resulting from this lack of continuity shows itself in various ways, particularly in lax book-keeping, absence of method, and in the frequent failure to notify to the Medical Officer of Health modifications of diagnosis.

At *Park Hill Hospital* the resident medical officer, Mr. Arthur B. Dunne, M.B., had been the resident assistant medical officer during the later stages of the smallpox epidemic. He succeeded, as senior resident, an officer who apparently took considerable care and trouble over the hospital books. Nevertheless there appeared to be one or two cases of smallpox which had been received into this hospital and which could not be traced in the hospital books. At *Priory Road Hospital* a portion of the book-keeping is done by the matron. Her knowledge of the cases that have passed through the hospital is so thorough that she was able to give information on every case, and where the information afforded by her could be checked she was invariably found to be correct. *Fazakerley Hospital* suffered from changes in the resident staff and from the fact that it is a new hospital and that it had to be opened for the reception of patients at a time when the hospital buildings were scarcely finished. Here, again, it was the matron who, having held office during the whole period that the hospital was receiving the patients, was able to give information concerning the smallpox patients that the hospital books failed to supply.

In this report the City hospitals receiving smallpox cases are alone dealt with, but it is manifest that the scheme of supervision of the whole of the City hospitals merits the attention of the Hospitals Committee of the Corporation.

At my first visit to Liverpool I asked for a list of the cases of smallpox which had occurred in the borough, and there was handed to me the "Book of known smallpox cases" which is kept in the office of the Medical Officer of Health. This book records the date of notification or the date on which a case of smallpox was otherwise discovered, the name of the street, number of the invaded house, the number of cases removed from each such house, the hospital to which the patient was taken, and the age of the patient. There is also in it a column for "remarks." But the patient's name is not given, nor are the cases numbered consecutively, though they are totalled at the end of each month. The number of cases of smallpox occurring in the borough as set forth in the special report on the outbreak by the Medical Officer of Health corresponds with the number of cases recorded in this book. But on investigation I found that this book (although no doubt satisfactory for the purpose for which it was intended) could not be relied upon as a complete index of the cases of smallpox which had occurred in the City during 1902–3, nor of the dwellings invaded by the disease. There were recorded as smallpox in this book cases as to which the diagnosis of smallpox had been revoked at the hospitals, the cases not proving to be smallpox; and, again, other cases marked in this book as "not infectious" had nevertheless been treated at the hospitals as smallpox, and one such case had died of a confluent attack. The difficulty of tracing these cases was increased owing to the patients not having always been removed to the hospital stated in the book. Further investigation of these derelict cases brought to light other smallpox cases which had been treated in the hospitals and as to which no information appeared to have reached the Medical Officer of Health. Thus, a woman carried her child, sick of the smallpox, into the Park Hill Hospital, but the staff of the hospital did not notify the case to the Medical Officer of Health. Nor could the hospitals' registers of cases be absolutely relied on; for some of the cases of smallpox had not been entered on such register, and it was only from examination of the patients' bed cards that it became possible to account in hospital for certain known cases.

Books for each hospital are kept at the office of the Medical Officer of Health, in which the name and address of the smallpox patient removed to the hospital and the date of removal are entered. Another book records the houses that have been disinfected for smallpox. But notwithstanding careful search through these books, and examination of the various registers and books kept at the hospitals, supplemented by inquiries in the town, and by all the assistance that could be rendered me by the officials of the Corporation, I failed to obtain the facts respecting one or two smallpox cases.

The result of this search, which necessarily occupied much time, is to remove from the "Book of known smallpox cases" for the period December, 1901, to December, 1903, inclusive, 35 cases as not having suffered from smallpox, as well as 33 cases of

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smallpox apparently removed directly from the shipping, and to add to the known smallpox cases 51 other cases.*

The figures to which I ultimately attained, and the lists of dwellings invaded by smallpox which I have in this way been able to obtain, are as complete as in the circumstances it has been possible to make them.

During one of my earlier visits to Liverpool I asked Mr. Brodie, the City Engineer, to prepare for me a map of Liverpool on the 25-inch Ordnance scale brought up to date. Later, when I had completed the list of smallpox cases and had made a list of the invaded houses, distinguishing the houses by special marks which had reference to definite periods of time, these marks were in his office all placed on the prepared map. To Mr. Brodie and Mr. Aman of his office, and to Mr. Wigglesworth, the draughtsman, I am indebted for much patient and painstaking work in this matter. Mr. Brodie also had made, in reference to each smallpox hospital, enumeration of the houses situate within one mile of the building, as also in concentric zones of this mile at distances respectively 0–$\frac{1}{4}$, $\frac{1}{4}$–$\frac{1}{2}$, $\frac{1}{2}$–$\frac{3}{4}$ and $\frac{3}{4}$–1 mile from hospital. He also made an estimate of the number of inhabited houses within the City of Liverpool.

Until 10th December, 1902, the acute cases of smallpox were, with the exception of a few cases taken to New Ferry Hospital and other few to Fazakerley Hospital, all removed to Priory Road Hospital. At this date, owing to the increasing number of cases, further hospital accommodation became necessary, and the Fazakerley Hospital was again opened for smallpox. Hitherto only eight cases had been received into this hospital between 18th March and 30th April, 1902. As the demand for isolation hospital accommodation continued to increase, Park Hill Hospital was cleared of its fever cases, and the blocks of ward pavilions of that establishment nearest to the river were taken into use for smallpox patients on the 12th January, 1903. After 26th May, 1903, no further cases of smallpox were received at Priory Road Hospital, and after 1st July, 1903, Park Hill Hospital ceased to receive smallpox patients.

Of these three hospitals, Fazakerley alone can be said to be comparatively remote from populous areas. Each of the other hospitals, Priory Road and Park Hill, is situated within the City of Liverpool, and each has in its neighbourhood a considerable inhabited area, which in each instance extends, as it were, half round the hospital. In neither case are there many dwellings as close to the hospital as a quarter of a mile. As regards Priory Road, the area within a quarter of a mile of the hospital is mainly occupied by a public park, a large cemetery, and open fields. In the case of Park Hill Hospital, one half only of the mile area is

* I would not be mis-understood as hypercritical in drawing attention to this matter. For I am fully aware of the difficulties of keeping exact records during a considerable epidemic, increased as in the case of Liverpool by the inadequate relation between the departments of the Medical Officer of Health and the hospitals; but for any statistical inquiry accuracy of record is of first importance, and it is desirable to indicate the reason for differences between the figures in this Report and those given by the Medical Officer of Health in his Special Report on the epidemic.

inhabited, the remainder (inclusive of docks and six dwellings*) consisting almost wholly of river. Within ½ mile of this hospital there are no more than 171 houses, almost all of them in the extreme landward side; the rest of the section of the quarter-mile area is occupied by docks and extensive park-like gardens.

The number of houses within these quarter-mile circles is, in the case of Priory Road Hospital, 85, and as regards Park Hill Hospital, 171. But within half a mile of Priory Road Hospital are as many as 2,055 dwellings, and within one mile 21,724 dwellings; within half a mile of Park Hill Hospital are as many as 2,430 dwellings, and within one mile 12,610 dwellings.†

The relation of these two hospitals to surrounding population is thus of a kind which is at the present day quite unusual when isolation of smallpox is in question; experience having led to general disuse for smallpox of hospitals having large amount of dwellings in their neighbourhood.

Experience of the sort in question, which is well known,‡ has demonstrated that excessive incidence of smallpox on populous areas in the vicinity of a hospital receiving a plurality of acute cases of the disease is no unusual occurrence, and it can hardly be doubted that the relationship between the operations of these hospitals and the excessive smallpox incidence in their neighbourhood is one of cause and effect. Further, it has been strongly

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* These six houses have been disregarded in the calculation I have been making. They were not invaded by smallpox.

† The corresponding numbers for the Fazakerley Hospital are—within ½ mile, 9; within ¾ mile, 175; within ¾ mile, 556; and within 1 mile, 1,423 dwellings.

‡ The following are references to some of the literature on the subject:—

"On the Influence of the Fulham Smallpox Hospital on the Neighbourhood surrounding it," by Mr. Power. (Tenth Annual Report of the Medical Officer of the Local Government Board, 1880-81. Report and Papers on the Use and Influences of Hospitals for Infectious Disease, No. 2, p. 302.)

"Report of the Royal Commissioners appointed to inquire respecting Smallpox and Fever Hospitals, with Minutes of Evidence and Appendix." (1882.)

"Report on Later Observations (1881-84) of the Influence of Fulham Smallpox Hospital on the Neighbourhood surrounding it," by Mr. Power. (Annual Report of the Medical Officer of the Local Government Board for 1884, No. 11, p. 55.)

"The Annual Report of the Medical Officer of Health of St. Pancras, London"—Mr. Shirley F. Murphy—for the year 1884.

"Memorandum on further Observation (1884-85) of the Influence of Fulham Smallpox Hospital on the Neighbourhood surrounding it," by Mr. Power. (Annual Report of the Medical Officer of the Local Government Board for 1885, No. 9, p. III.)

"Statistics of Smallpox Incidence upon the Registration Districts of London, relatively to the Operations of Smallpox Hospitals in the Metropolis: in a succession of chapters," by Mr. Power. (Annual Report of the Medical Officer of the Local Government Board for 1886, No. 7, p. 41.)

"Report by Mr. W. H. Power on the behaviour of Smallpox at West Ham during the Epidemic of 1884-85." (Annual Report of the Medical Officer of the Local Government Board for 1886, No. 8, p. 97.)

"Notes on an Outbreak of Smallpox at Nottingham in 1887-88," by Dr. B. A. Whitelegge, Medical Officer of Health. Practitioner, Vol. XLI., No. 1, p. 66.

"Report on the Health of Oldham for the year 1892," by Dr. Niven.

"Report on the Epidemic of Smallpox, in years 1892-3, in the Borough of Warrington," by Dr. Guest Gornall.

"Report on the Outbreak of Smallpox in the Borough of Warrington in 1892-93," by Dr. Savill. (Appendix V. to the Final Report of the Royal Commission on Vaccination, 1897.)

"The Aërial Convection of Smallpox from Hospitals," by John C. McVail, M.D., Trans. Epidem. Soc. of London, Vol. XIII., N.S., p. 38.

Paper on "The Aërial Convection of Smallpox" at the Meeting of the Section on Public Medicine (3rd August, 1894) of the British Medical Association (Bristol). Brit. Med. Journal, 18 August, 1894, pp. 356-8, by Dr. Arnold Evans.

"Report on Smallpox in Glasgow, 1900-02," by Dr. Chalmers, Medical Officer of Health.

"Report on Epidemic Smallpox in the Union of Orsett, 1901-02," by Dr. Buchanan.

"Smallpox Hospitals and the Spread of Infection," Trans. Epidem. Soc. of London, Vol. XXI., N.S., p. 101, by Dr. Thresh.

On Smallp
and Small
Hospitals
Liverpool,
1902-3; by
Dr. Reece.

until the end of the epidemic in 1903. No case of [illegible]

The Health Department on Site Assessment, 2006

until the end of the epidemic in 1903. No cases

imported into the town from the shipping and no case brought by tramps have been taken into consideration when the smallpox has developed within less than two weeks of such person's arrival in Liverpool. Persons in this category clearly did not acquire their infection in the City of Liverpool. On the appended maps* invaded houses were alone indicated, and no house that during the epidemic was once infected has been, on secondary cases occurring in it, again marked on the maps, no matter what period elapsed between the attacks of inmates. Study of these maps showed that the first case of smallpox, of the epidemic that is under review, occurred near the centre of the City. This house, which is a common lodging house, became infected by an imported case from the shipping, the first Liverpool patient being a resident in the house.† Omitting imported cases, no further Liverpool person was attacked until the second week in January, 1902. The patients from these houses earliest invaded, as well as imported cases from the shipping, were, as has been stated, removed to the Priory Road Hospital.

Having obtained these data, I had to study the Liverpool smallpox hospitals, singly and in the aggregate, in reference to considerations which follow :—

(1.) Has the inhabited area within a mile in each instance of hospital suffered more severely than the rest of Liverpool? And if so—

(2.) Has the exceptional incidence within that area corresponded in point of time (having regard, of course, to the period of incubation of smallpox) to the use of the hospital for the treatment of acute smallpox cases? And—

(3.) Is there evidence that within the several "one-mile areas," as they may be termed, dwellings nearer to hospital sustained a heavier incidence of smallpox than those farther away?

It must be remembered that smallpox has a definite incubative period, and that the earliest symptom of the disease does not declare itself until some 12 days after infection.

Consequently the figures in the tables of this report must be considered with due recognition of this fact.

In the accompanying table (Table II.) is recorded, fortnight by fortnight, in the period 8th December, 1901, to 7th November, 1903 —(*a*) The number of cases of smallpox in Liverpool which were

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* With the report as published was a series of 23 maps showing the distribution of dwellings invaded by smallpox in Liverpool during 50 consecutive fortnights. These maps have not been reproduced.

† The patient was the son of the keeper of the common lodging house. He was not, however, taken to hospital from his father's house, having been removed, when attacked by smallpox, to another house in the City to avoid detection. The case was only discovered by the officers of the Health Department on 27th December, 1901.

removed to the three City smallpox hospitals*; (*b*) the number of houses invaded by smallpox in the area within a mile of each hospital, and in certain subordinate zones; (*c*) the number of houses invaded in the rest of the City, more than a mile from any of the hospitals; (*d*) the rate of houses invaded by smallpox per 10,000 houses for each of the three hospitals areas, and for the rest of the City excluding these areas.

The invasion rate per 10,000 houses for the City of Liverpool and for each of the special areas within a mile radius of each of the three hospitals is also shown graphically in the Diagram I.; the actual number of patients received into each of the three hospitals, separately and in the aggregate, is shown graphically in Diagram III. annexed.

Study of Table II., and of Diagram I. showed that in the earlier fortnights of smallpox prevalence in Liverpool the invaded houses were not only few in number but were usually separated from each other by long distances. One invaded house was situate in the Park Hill Hospital area, 3rd fortnight, though this hospital was not at that time receiving patients. Also the 5th fortnight showed three invaded houses in the Priory Road Hospital area; and later (6th and 7th fortnights) two additional dwellings within this area were invaded by the disease, the rest of the invaded dwellings in the City being scattered at this time about the town, and the Park Hill Hospital area having become affected.

PRIORY ROAD HOSPITAL.

The period of increased activity of smallpox reception at the Priory Road Hospital, shown in Table II. in the fortnights 5–7, is followed a fortnight later (8th fortnight) by a rise in the invasion rate of the houses within one mile of this hospital, constituting (the hospital areas being excluded), an incidence considerably in excess of that for the City of Liverpool. A like special incidence on houses within one mile of hospital occurs in sequence to fortnights 16, 17, 18, during which the number of acute cases in Priory Road Hospital again somewhat increased. Thus, in the 19th fortnight, the invasion rate of the houses in the special area here rose largely above that for the City. A similar state of things can be seen in fortnights 22 and 23. Thereafter the operations of the other hospitals which were now receiving patients tend to obscure the effect of operations of the Priory Road Hospital. But it will be observed from Table II., and Diagram I., that there continued to occur considerable incidence of smallpox within the special area of the Priory Road Hospital while that hospital continued in active receipt of acute cases.

In the 24th fortnight, 26th October to 8th November, 1902, a house was invaded (6th November) in Conway Street, *outside* the

* The cases taken to the New Ferry (Port Sanitary) Hospital, on the Birkenhead side of the River Mersey, are not included in this list, as this hospital probably had no concern with spread of smallpox in Liverpool.

DIAGRAM I. SHOWING THE INCIDENCE PER 10,000 HOUSES IN EACH INSTANCE OF HOUSE INVASION BY SMALL-POX ON AREAS OF LIVERPOOL SEVERALLY WITHIN ONE MILE OF A SMALL POX HOSPITAL AND IN THE REST OF THE CITY IN FIFTY SUCCESSIVE FORTNIGHTS 1901-03.

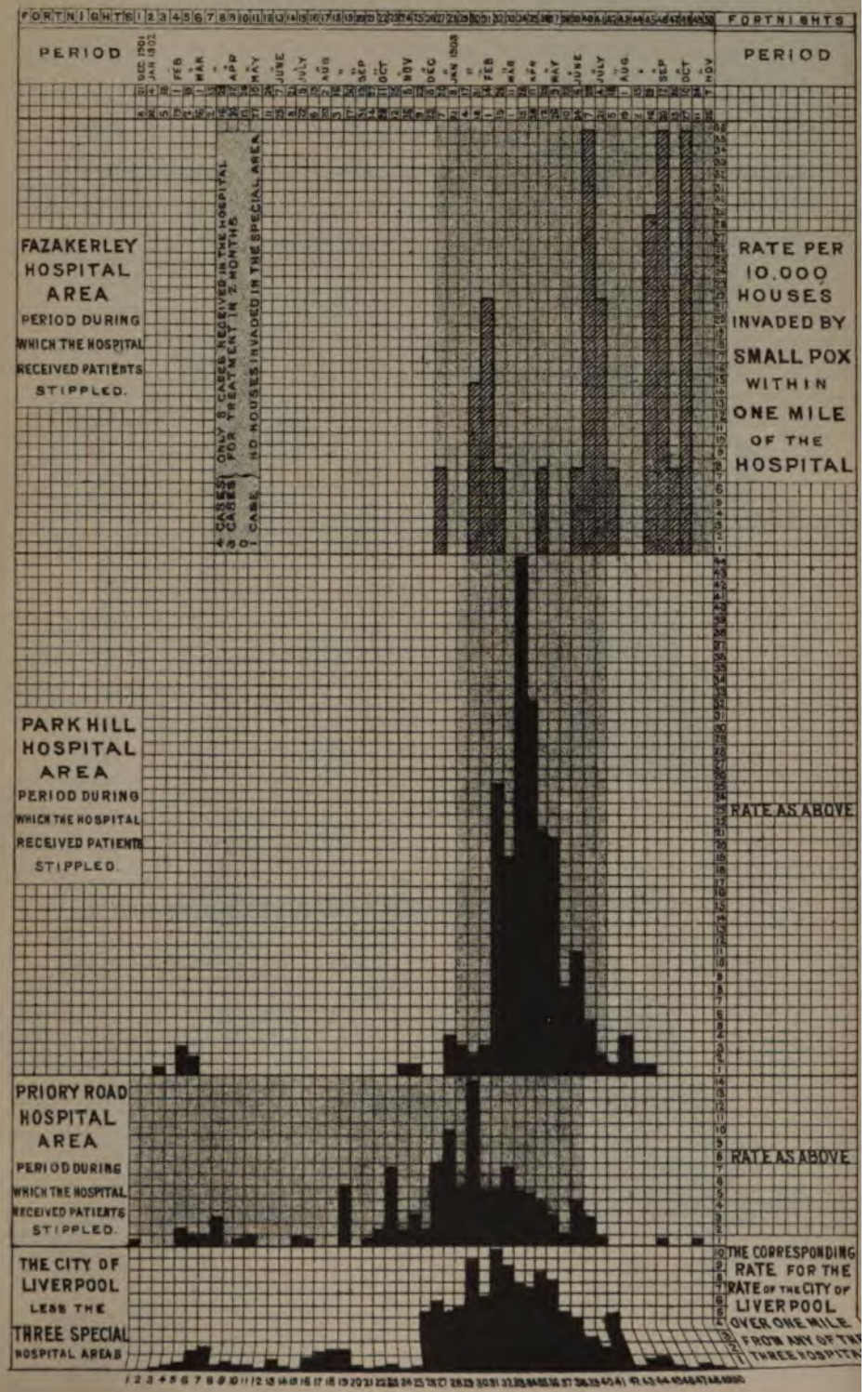
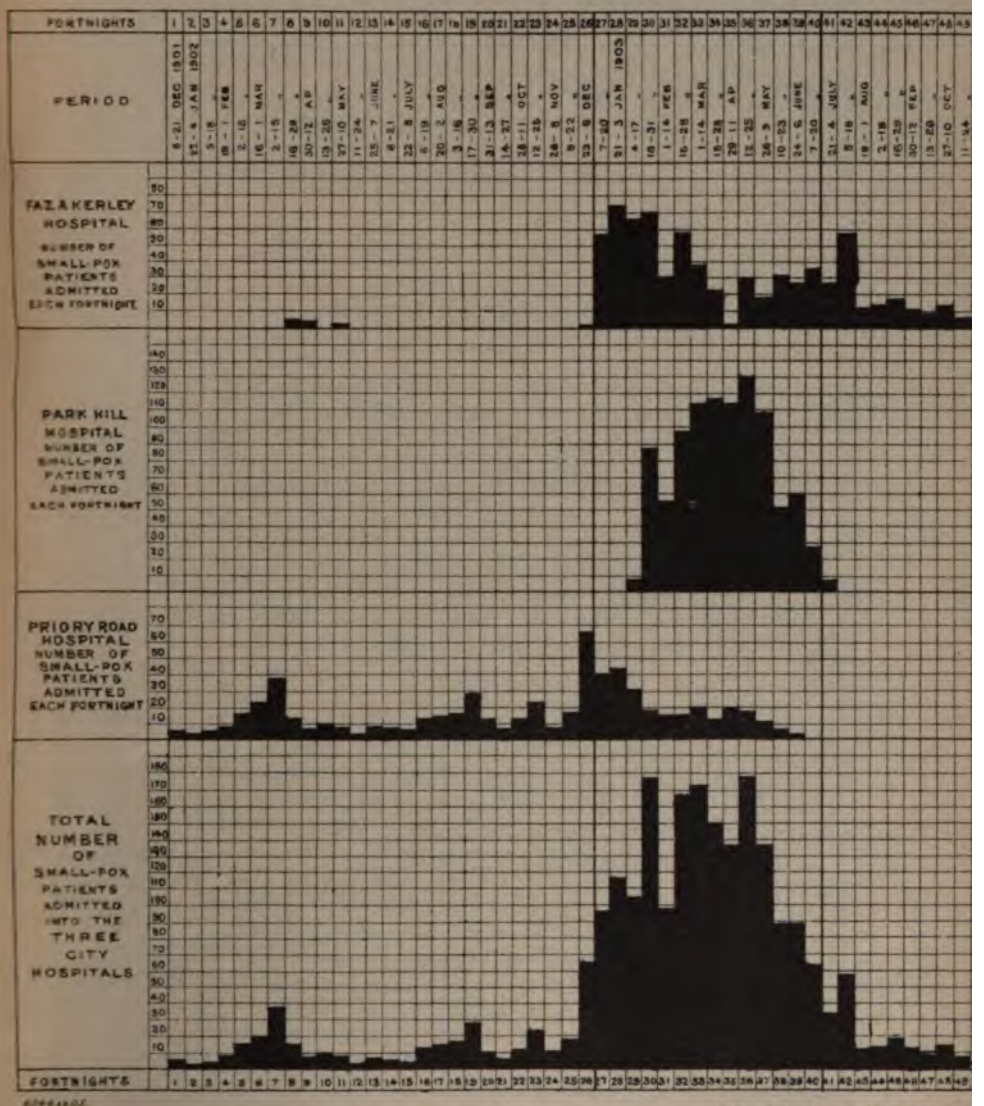

FORTNIGHTS
PERIOD
DEC 1901
JAN 1902
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
DEC
JAN 1903
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEP
OCT
NOV
4 CASES
3 CASES
2 CASES
1 CASE
0 CASES
ONLY 8 CASES RECEIVED IN THE HOSPITAL FOR TREATMENT IN 2 MONTHS.
NO HOUSES INVADED IN THE SPECIAL AREA.
FAZAKERLEY HOSPITAL AREA
PERIOD DURING WHICH THE HOSPITAL RECEIVED PATIENTS STIPPLED.
PARK HILL HOSPITAL AREA
PERIOD DURING WHICH THE HOSPITAL RECEIVED PATIENTS STIPPLED.
PRIORY ROAD HOSPITAL AREA
PERIOD DURING WHICH THE HOSPITAL RECEIVED PATIENTS STIPPLED.
THE CITY OF LIVERPOOL LESS THE THREE SPECIAL HOSPITAL AREAS
RATE PER 10,000 HOUSES INVADED BY SMALL POX WITHIN ONE MILE OF THE HOSPITAL
RATE AS ABOVE
RATE AS ABOVE
THE CORRESPONDING RATE FOR THE RATE OF THE CITY OF LIVERPOOL OVER ONE MILE FROM ANY OF THE THREE HOSPITALS
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50
FIFTY CONSECUTIVE FORTNIGHTS COMMENCING 8TH DECEMBER 1901.

DIAGRAM III

SHOWING FORTNIGHT BY FORTNIGHT FROM 8TH DECEMBER 1901 TO 7TH NOVEMBER 1903 THE NUMBER OF SMALL POX PATIENTS RECEIVED INTO THE LIVERPOOL CITY HOSPITALS


FORTNIGHTS
PERIOD
FAZAKERLEY HOSPITAL
NUMBER OF SMALL-POX PATIENTS ADMITTED EACH FORTNIGHT
PARK HILL HOSPITAL
NUMBER OF SMALL-POX PATIENTS ADMITTED EACH FORTNIGHT
PRIORY ROAD HOSPITAL
NUMBER OF SMALL-POX PATIENTS ADMITTED EACH FORTNIGHT
TOTAL NUMBER OF SMALL-POX PATIENTS ADMITTED INTO THE THREE CITY HOSPITALS
FORTNIGHTS

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Priory Road Hospital area, and in the 25th fortnight (9th to 22nd November), four additional houses were invaded in the immediate neighbourhood of this house. It was in one of these—28, Robsart Street—that a child was found on 12th November dying of smallpox. No doctor had been in attendance until the child was moribund, and it died before it could be removed to hospital. The result of this undetected and unnotified case was shown in the 26th fortnight, 23rd November to 6th December, by a group of some 24 invaded houses in the immediate neighbourhood of Robsart Street. The following fortnights, 7th December, 1902, to 17th January, 1903, showed the spread of smallpox in the locality of Robsart Street, and its diffusion over the City; and, in sequence to the large number of acute cases received in the Priory Road Hospital in December, a special incidence on that hospital district. The immediate result of this influx of cases to the Priory Road Hospital was to swamp the available accommodation for patients in this hospital and to necessitate the opening of the Fazakerley and Park Hill Hospitals for smallpox patients.

Park Hill Hospital.

During 1902, smallpox occurred more than once within the Park Hill Hospital area antecedent to employment of this hospital for reception of smallpox. But no exceptional incidence had followed here, as will be seen from Table II., and Diagram I. Subsequent, however, to opening the Park Hill Hospital for smallpox patients on 12th January, 1903, the experience was very different. At the time when this hospital began to receive smallpox, the disease was generally prevalent throughout the City. Three cases only of smallpox were admitted to Park Hill Hospital on 12th January, and four more on 13th January. No other cases were admitted to the hospital until 26th January, when eight additional cases were admitted, and four others on 27th January. In the next few days, however, this hospital commenced operations on a large scale. From the 28th to 31st January, no less than 76 acute cases were admitted thereto. Hence it was to be anticipated that hostile influence of the hospital on the surrounding houses if it took place at the earliest possible time, would not show itself conspicuously before mid-February. Reference to Table II., and Diagram I., shows that this really took place; that in the 32nd fortnight, 15–28th February, the incidence of house invasion by smallpox in the area within one mile of Park Hill Hospital rose to 24·58 per 10,000 houses, the rate for the rest of the City outside the hospital areas being in the same fortnight, 9·70. Further, that so long as the Park Hill Hospital continued to receive acute smallpox cases, the invasion rate on the houses in the area within one mile of this hospital continued out of all proportion to that on the rest of the City. A few weeks after this hospital ceased to receive patients, smallpox faded out of the Park Hill Hospital area.

'P. A, No. 10.

Smallpox
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Reece.

Fazakerley Hospital.

It has been stated that eight cases of smallpox were received in Fazakerley Hospital duriug the two months, 16th March -10th May, 1902 (fortnights 8–11). No further cases were admitted there until December of the same year, when, between 10th and 20th, 57 acute cases were admitted to the institution. To this date one house only in the special hospital area within one mile of Fazakerley Hospital had been invaded by smallpox. The number of houses inside the Fazakerley Hospital special area is, however, small, and hence the invasion rate shown in its relationship to 10,000 houses necessarily appears in Diagram I. by long columns. On account of the insignificant figures concerned, no great stress is to be laid upon rates on the area within one mile of Fazakerley Hospital in comparison with incidence of smallpox elsewhere in Liverpool. As a matter of fact not more than 33 houses were invaded by smallpox in the whole of the two years under consideration. Nevertheless, the fact remains that the opening of this hospital for the reception of a plurality of acute cases of smallpox was followed at once by definite incidence of smallpox on dwellings within a mile of the hospital, an area on the confines of Liverpool in which, with the single exception noted, no smallpox cases had previously occurred. Moreover, until the total number of cases in the whole of Liverpool dropped to very small numbers, a special incidence of smallpox on this hospital area continued to be manifested.

It was indeed in this hospital that all cases of smallpox which occurred towards the end of the epidemic were isolated, and it is noteworthy that at the time when smallpox had ceased to occur in the other hospital areas, such smallpox as Liverpool continued to suffer was to be found mainly in the neighbourhood of Fazakerley Hospital.

The incidence of smallpox in separate sections of each special hospital area has now to be considered.

For fortnights, 1 to 26—*i.e.*, from 8th December, 1901, to 6th December, 1902—cases of smallpox were (with the exception already alluded to of eight cases removed to Fazakerley Hospital) all of them treated in the Priory Road Hospital. In this period houses situated within one mile of the Priory Road Hospital suffered a greater incidence of smallpox than the rest of the houses in Liverpool, including the other two hospital "special" areas. Further, within this mile circle the houses situated within half a mile of the hospital show a greater rate of invasion by smallpox than do the houses within three-quarters of a mile of the hospital, and this latter rate is again greater than that for the houses within the mile circle of the hospital. The figures are shown in the accompanying table.

TABLE III., showing, per 10,000 Houses, and for the period 8th December, 1901, to 6th December, 1902, houses invaded by Smallpox in areas respectively within one mile, within three-quarters of a mile, and within half a mile of the Smallpox Hospital at Priory Road. The corresponding rate for the rest of the City (including the two hospital areas of the Park Hill and Fazakerley Hospitals) is given for comparison :—

Period during which Priory Road Hospital was alone used for reception of Acute Smallpox patients.	Priory Road Hospital Area; House invasion, per 10,000 houses, within—			House invasion per 10,000 houses in rest of City of Liverpool, including the Hospital Areas of Park Hill and Fazakerley Hospitals.
	1 mile of the Hospital.	¾ mile of the Hospital.	½ mile of the Hospital.	
8th December, 1901, to 6th December, 1902.	27·6	33·3	68·1	16·0

Thus, whereas the invasion rate was only 16·0 per 10,000 houses in the City outside the Priory Road Hospital area, it was 27·6 on houses situate within one mile of the hospital, more than double the rate for the City within three quarters of a mile of the hospital, and more than four times the City rate within half a mile of the hospital.

The next succeeding period, 7th December, 1902, to 20th June, 1903, was one of full activity at all three smallpox hospitals. The data in regard to the several sub-divisions of each of the hospital areas during successive fortnights (27–40) are shown in detail in Table II. Taking for this period, and in respect of all three hospitals together, the inhabited areas, respectively, ¼, ½, ¾, and 1 mile from hospital, the following figures are obtained :—

TABLE IV., showing per 10,000 Houses, and for the period 7th December, 1902, to 20th June, 1903, Houses invaded by Smallpox in areas respectively within one mile, within three-quarters of a mile, within half a mile, and within a quarter of a mile of one or other of the three Smallpox Hospitals (Priory Road, Park Hill, and Fazakerley). The corresponding rate on the Houses for the rest of the City outside the one mile Hospital areas is given for comparison.

Period during which all three Hospitals were used for reception of acute Smallpox Patients.	The Three Hospital Areas; House invasion, per 10,000 houses, within—				House invasion per 10,000 houses of houses situate in the rest of the City of Liverpool.
	1 Mile of the Three Hospitals.	¾ Mile of the Three Hospitals.	½ Mile of the Three Hospitals.	¼ Mile of the Three Hospitals.	
7th December, 1902, to 20th June, 1903.	114·7	128·8	222·3	415·2	85·9

The contrasts exhibited in Table IV., though not relatively so great as those shown in Table III., are nevertheless sufficiently indicative of unfavourable influence of these hospitals on the houses in their neighbourhood.

A zone by zone study of the behaviour of smallpox within Hospital special areas, after the fashion adopted in previous reports to the Board, not only fully confirms the indications already adduced but goes far to suggest graduation of smallpox incidence from centre to periphery within the Hospital areas to a distance of at least half a mile. Briefly, the results of such study are embodied in the following tabular statements and in Diagram II.

Priory Road Smallpox Hospital.

8th December, 1901, *to 6th December*, 1902.

Houses invaded per 10,000 *houses in each instance.*

Zones.	0–¼ mile (Houses in the Zone, 85).	¼–½ mile (Houses in the Zone, 1,970).	½–¾ mile (Houses in the Zone, 7,257).	¾–1 mile (Houses in the Zone, 12,413).	All the rest of the City of Liverpool (Houses 114,476).
Invaded houses ...	—	71·07	23·43	23·37	16·00

All Three Smallpox Hospitals.

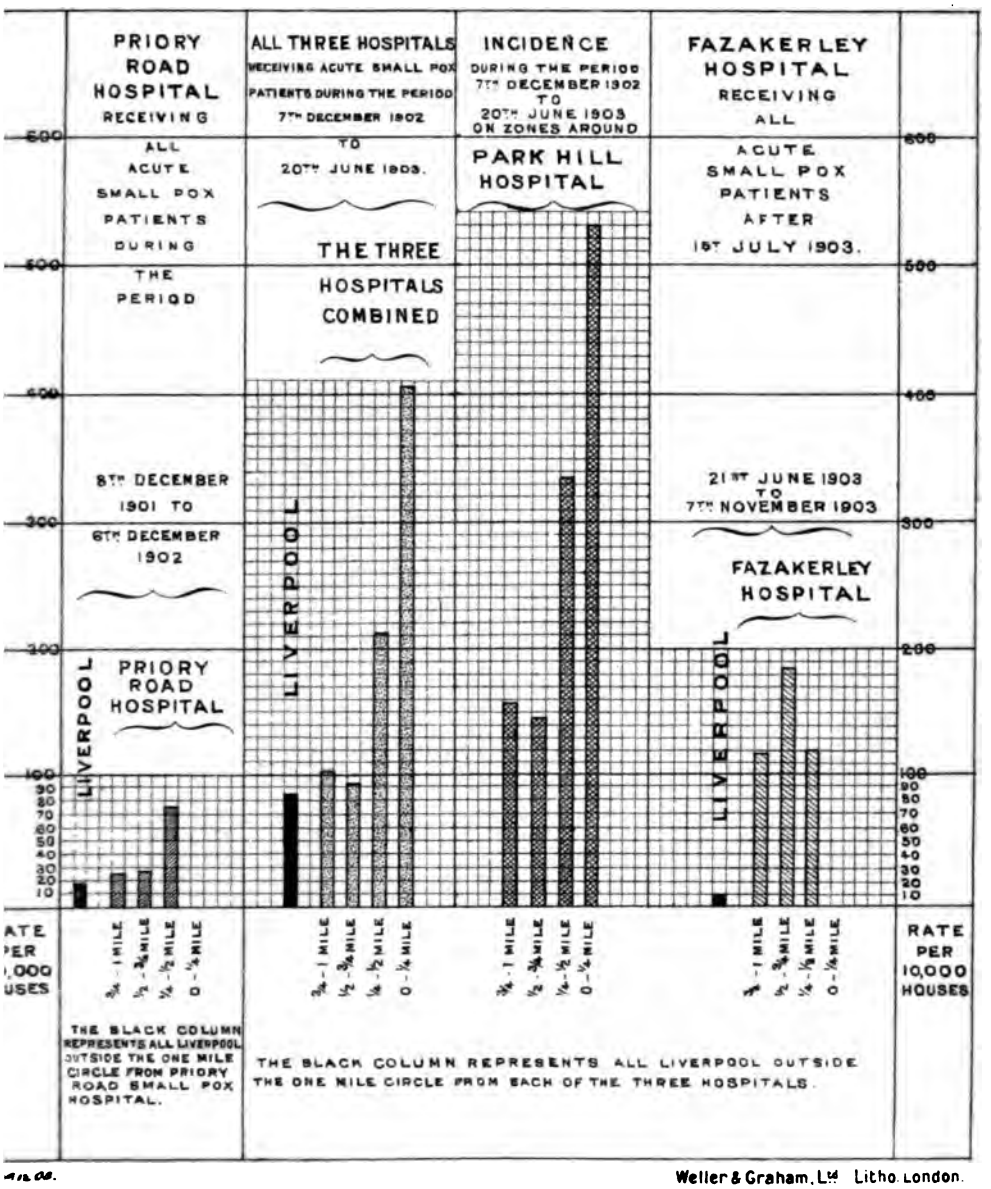
7th December, 1902, *to 20th June*, 1903.

Houses invaded per 10,000 *houses in each instance.*

Zones.	0–¼ mile (Houses in the Zone, 265).	¼–½ mile (Houses in the Zone, 4,393).	½–¾ mile (Houses in the Zone, 12,201).	¾–1 mile (Houses in the Zone, 18,996).	All the rest of the City of Liverpool Outside the Three Hospital areas (Houses 100,969).
Invaded houses ...	415·2	211·6	92·6	102·2	85·9

Diagram II.

lowing in successive periods, December 1901 to November 1903, the incidence of Small Pox vasion, per 10,000 houses in each instance, in the several areas within one mile of verpool Small Pox Hospitals, and on certain sub-divisions of those areas. For irposes of comparison the "invasion rate" in each period of the houses of verpool as a whole is shown in each instance by a Black Column.


PRIORY ROAD HOSPITAL RECEIVING ALL ACUTE SMALL POX PATIENTS DURING THE PERIOD
8TH DECEMBER 1901 TO 6TH DECEMBER 1902
LIVERPOOL
PRIORY ROAD HOSPITAL
ALL THREE HOSPITALS RECEIVING ACUTE SMALL POX PATIENTS DURING THE PERIOD 7TH DECEMBER 1902 TO 20TH JUNE 1903.
THE THREE HOSPITALS COMBINED
LIVERPOOL
INCIDENCE DURING THE PERIOD 7TH DECEMBER 1902 TO 20TH JUNE 1903 ON ZONES AROUND
PARK HILL HOSPITAL
FAZAKERLEY HOSPITAL RECEIVING ALL ACUTE SMALL POX PATIENTS AFTER 1ST JULY 1903.
21ST JUNE 1903 TO 7TH NOVEMBER 1903
FAZAKERLEY HOSPITAL
LIVERPOOL
600
500
400
300
200
100
90
80
70
60
50
40
30
20
10
¾ - 1 MILE
½ - ¾ MILE
¼ - ½ MILE
0 - ¼ MILE
RATE PER 10,000 HOUSES
THE BLACK COLUMN REPRESENTS ALL LIVERPOOL OUTSIDE THE ONE MILE CIRCLE FROM PRIORY ROAD SMALL POX HOSPITAL.
THE BLACK COLUMN REPRESENTS ALL LIVERPOOL OUTSIDE THE ONE MILE CIRCLE FROM EACH OF THE THREE HOSPITALS.

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PARK HILL SMALLPOX HOSPITAL ALONE.*

7th December, 1902, *to* 20*th June*, 1903.

Houses invaded per 10,000 *houses in each instance.*

Zones.	0–¼ mile (Houses in the Zone, 171).	¼–½ mile (Houses in the Zone, 2,259).	½–¾ mile (Houses in the Zone, 4,563).	¾–1 mile (Houses in the Zone. 5,617).	All the rest of the City of Liverpool Outside the Three Hospital Areas (Houses 100,969).
Invaded houses ...	526·3	331·6	146·8	158·4	85·9

* *See* Diagram II.

In the case of Fazakerley Hospital, the number of dwellings within the mile area is not sufficiently large to enable rates for the several zones to be contrasted with any degree of confidence; the number of newly invaded dwellings in the four zones (respectively 0, 2, 7, and 10), during the last half of the year 1903, when Fazakerley alone of Liverpool hospitals was in use for acute cases of smallpox are represented by rates as follows :—

FAZAKERLEY SMALLPOX HOSPITAL.

21*st June to* 7*th November*, 1903.

Houses invaded per 10,000 *houses in each instance.*

Zones.	0–¼ mile (Houses in Zone, 9).	¼–½ mile (Houses in Zone, 166).	½–¾ mile (Houses in Zone, 381).	¾–1 mile (Houses in Zone, 867).	All the rest of the City of Liverpool Outside the Three Hospital Areas (Houses 100,969).
Invaded houses ...	—	120·5	183·8	115·4	8·7

Within one mile of the Fazakerley Hospital are the Cottage Homes of the West Derby Union, wherein the inmates are all vaccinated and revaccinated. No case of smallpox occurred in these homes during the period embraced by this Report.

On consideration of all the facts here recorded, there can be no question as to the conclusions to be arrived at. Namely, that—

(1.) Inhabited areas within a mile of each of the three Liverpool smallpox hospitals have suffered more severely from smallpox than the city as a whole.

(2.) Exceptional incidence of smallpox within these areas has corresponded in point of time with the use of these hospitals for the treatment of acute smallpox cases.

(3.) Broadly speaking, within these hospital areas the dwellings nearer to hospital have sustained a far heavier incidence of smallpox than those further away.

The above experience is most conspicuously illustrated in respect of Park Hill, a large hospital receiving many smallpox patients at the height of the epidemic (Diagram II.). But it is also shown in the case of the smaller Priory Road Hospital, particularly in the earlier months of the epidemic when this hospital alone was used for smallpox isolation. Similarly it is indicated in the case of Fazakerley Hospital, which being situated in a much more sparsely populated district than Priory Road or Park Hill Hospitals, affords data of comparatively less value in this connexion than the other hospitals.

Looking to all the circumstances which have come under review I am compelled to consider that the influence of these hospitals has been responsible in material degree for the considerable and sustained prevalence of smallpox in Liverpool in 1902–3.

No. 11.

MEMORANDUM PREPARED by the MEDICAL OFFICER and CIRCULAR ISSUED by the LOCAL GOVERNMENT BOARD in 1904 relating to QUESTIONS AFFECTING the PUBLIC HEALTH.

APP. A, No. 1
Memorandum and Circular issued in 1904

A. MEMORANDUM :—

Memorandum on the Circumstances under which the Closing of Public Elementary Schools or the Exclusion therefrom of particular Children may be required in order to prevent the Spread of Disease. (August, 1904.)

B. CIRCULAR :—

Seizure and Condemnation of Tuberculous Meat. To Councils of Metropolitan and other Boroughs, and of Urban and Rural Districts. (7th September, 1904.)

A.

Memorandum, prepared in the Medical Department, on the Circumstances under which the Closing of Public Elementary Schools or the exclusion therefrom of particular Children may be required in order to prevent the Spread of Disease.

Objects of memorandum

1. It is attempted in these notes to bring together the information in the possession of the Local Government Board, derived from the reports of the Board's own Medical Inspectors and of local Medical Officers of Health, respecting school-closure and exclusion from school as precautions against infection, with a view to indicate the best means of preventing the spread of disease by school children among their fellows, while avoiding any unnecessary interruption of the work of education.

Regulations of Board of Education.

2. In the Code of Regulations issued by the Board of Education in 1904, the following Article (Art. 57) prescribes, as one of the general conditions required to be fulfilled by a Public Elementary School in order to obtain an annual Parliamentary grant, that—

"If the Sanitary Authority of the District in which the school is situated, or any two members thereof acting on the advice of the Medical Officer of Health, require either the closure of the school or the exclusion of certain children for a specified time, with a view to preventing the spread of disease or any danger to health likely to arise from the condition of the school, such requirement must at once be complied with, but after compliance appeal may be made to the Board (of Education) if the requirement is considered unreasonable."

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Article 45 (b) prescribes that "if there has been a closure under "medical authority, or for any other unavoidable cause, the number "of meetings required (400 a year) is proportionately decreased."

(The "medical authority," referred to in this Article is not necessarily that of the Medical Officer of Health.)

Diseases principally requiring action.

3. The diseases for the prevention of which school closure, or the exclusion of particular children, will be required are principally those which spread by infection directly from person to person, such as diphtheria, scarlet fever, measles, whooping-cough, epidemic influenza, small-pox, and rötheln. More rarely, the same questions arise in connexion with enteric fever and diarrhœal diseases, which spread not so much by direct infection from person to person as indirectly through the agency of local conditions, such as infected school privies.

4. It will be seen that Article 57 quoted above confers upon sanitary authorities an alternative power with respect to public elementary schools.

(A.) To cause particular scholars to be for a specified time excluded from attendance, or

(B.) To require the school to be closed for a specified time.

Exclusion of scholars:

5.—*A. First, as to exclusion from school of particular scholars.*—Here it will be convenient to consider the circumstances under which the requirements of the public health will be satisfied by the less severe measure of the exclusion from school of particular children.

(*a.*) It may be laid down as a universal principle that all children suffering from any dangerous infectious disorder (*i.e.*, of a nature dangerous to some of the persons attacked by it, however mild in other cases) should be excluded from school until there is reason to believe that they have ceased to be in an infectious condition (*see* section 126 of the Public Health Act, 1875).

from infected houses,

(*b.*) Furthermore, as it is rarely possible to provide effectual separation of the sick from the healthy within the homes of children of the class attending public elementary schools, it must commonly be necessary that all children of an infected household should be excluded from school; first, because otherwise such children might attend school while suffering from the disease in a latent form, or at an unrecognized stage, and, secondly, because it is known that infection may attach itself to, and be conveyed by, the clothes of a person living in an infected atmosphere, even though the person himself remain unaffected. The

from particular localities.

same considerations will sometimes make it desirable to prohibit the attendance at school of all children from a particular street or hamlet.

In the case of infectious diseases involving little or no danger to life, such as mumps or skin diseases, school interests may be more particularly considered. In such case, however, it will usually be well for the Medical Officer of Health to advise the managers to prohibit the attendance of every child while in an infectious state.

Closing of schools:

6.—*B. Secondly, as to the closing of schools.*—This, by more seriously interfering with the educational work of a district, is a much more grave step for a sanitary authority to take than to direct the exclusion of particular scholars. It is a measure that seldom ought to be enforced, except under circumstances involving imminent risk of an epidemic, nor even then as a matter of routine nor unless

when to be required.

there be a clear prospect of preventing the propagation of disease such as could not be looked for from less comprehensive action.

The mere fact that in an epidemic many of the sufferers are school children does not necessarily show that the disease was caught at school; but the school may with probability be regarded as spreading infection if in a large majority of households attacked the first case be a child attending school; and with still greater probability if a number of children living at a distance from one another, and with no circumstances in common, except that they attend the same school, should be simultaneously attacked, and if it can be ascertained that a child or teacher in an infectious state has actually been attending the school.

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Duty of Medical Officer of Health when infectious disease occurs.

7. By Article 18 (6) of the Board's Order of 23rd March, 1891, the Medical Officer of Health on the occasion of an outbreak of dangerous infectious disease is to advise the persons competent to act as to the measures to be taken to prevent the extension of the disease. If, therefore, he finds that the children of infected households are attending school, he should send notice of the fact to the schoolmaster, and give such advice as appears to him to be necessary with regard to the exclusion of the children from school, and as to the time for which such exclusion should continue.

Where the number of children to be excluded is small, and the schoolmaster acts on the advice of the Medical Officer of Health, it may not be necessary to take formal action under Article 57 of the code; but where the number of children whom it is desirable to exclude from school is such as is likely seriously to diminish the average attendance, or where the advice of the Medical Officer of Health is not followed, and there is danger of the disease spreading by means of the school, notice for the exclusion of the children in question should be made in accordance with the requirements of Article 57.

Aid which schoolmaster and others ca give.

The attention of school attendance officers and of schoolmasters should also be drawn to the following considerations. Frequently they themselves will obtain the earliest information of the occurrence of infectious disease among scholars, and it is most desirable that such officer or master should without delay communicate the facts to the Medical Officer of Health. Absence of any child from school on the plea that it is suffering under one of the before-mentioned diseases, and absence of several children of one family from school at the same time, no matter what name be given to the complaint that keeps them at home, should be reported to the health officer. In practice it has been found that this notification of absentees has materially aided the local health officer in taking measures for the suppression of infectious disease, to the advantage alike of the district and of the school. Furthermore, schoolmasters may properly be asked to take note, especially when an epidemic threatens or is present, of symptoms occurring in any of their scholars that may indicate the commencement of disease, febrile in nature. Besides heat of skin, such symptoms are shivering, headache, and languor, especially if commencing suddenly, vomiting, rashes on the skin, and sore throat. When scarlet fever or diphtheria is about, every trace of sore throat should be looked upon as suspicious. In any case where such symptoms are observed, the safest course will be to exclude the child from school until assurance can be had that it may attend school without harm to itself or danger to other scholars.

Exclusion of particular scholars; duration of.

8. As regards duration of exclusion from school of particular children, the time to be specified will vary in different diseases and different cases, and in this matter the sanitary authority will doubtless be guided by the advice of their Medical Officer of Health.

Consideration which should determine period.

Medical officers of health, having to specify a time during which any scholars are to be excluded from attendance at any school, should have regard as far as practicable to the circumstances of the particular scholars suffering from infectious disease or living in infected households. Not only the nature of the infection and the length of illness, but the environments of the individual as affecting the retention of infection will deserve consideration. The period of exclusion, for example, will need to be different according to the conditions of a patient's lodgment, according to the sufficiency of the separation that can be effected between a patient and excluded scholars, and according to the opportunities of effectual disinfection that can be afforded to the household. Thus a hard and fast rule, such as has been laid down in some districts where scarlatina has been present, that no child shall go to school from an infected house for three months after the disease has begun in that house, is not to be commended. It is indeed possible that under the circumstances of a particular household, a child convalescent from scarlatina or living in the same house with convalescents should not in the interests of other children be permitted to return to school until after so long a period as this; but the same ought not to be assumed of all households in the district that may be invaded by scarlatina. The better plan would be for the sanitary authority to secure, during a shorter period, the exclusion of individual sick persons and their housemates from school; and when that period is about to expire to cause fresh inquiry to be made as to the expediency of further exclusion, and, if found requisite in particular cases, to cause fresh notice to be given to the school managers.

Period of exclusion may be prolonged by new notice

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9. In deciding whether an outbreak of infectious disease among children of school age may be best combated by closing the school, or whether it will suffice to exclude the children of infected households, the two most important points to be considered are :—

Whether exclusion or school closure to be preferred.

(*a.*) The completeness and promptness of the information received by the officers of the sanitary authority respecting the occurrence of infectious cases.

(*b.*) The opportunities which exist for intercourse between the children of different households elsewhere than at school.

When exclusion system to be preferred.

10. (*a.*) The more prompt and full the knowledge of cases of infectious disease that the sanitary authority are able to obtain, the better will be the prospect of checking such disease by keeping away from school the children of infected households, and the less will be the necessity for closing schools.* If the cases be few in number, and their origin known, the exclusion from school of the children of infected households will probably suffice, but this measure will fail where there are many undiscovered or unrecognized cases, or where the known centres of infection are very numerous.

When total closure of school preferable.

Commonly, the failure of carefully considered measures of exclusion to stay the spread of an epidemic which shows a special incidence upon school children, may be regarded as pointing to the continued attendance at school of children with the prevalent disease in a mild or unrecognized form, and a strong case will appear for the closing of schools.

If by reason of the absence or exclusion of a considerable number of children, the attendance at a school be greatly reduced, it may be found better to close it altogether. This is especially apt to occur in the case of epidemics of measles, a disease which is very infectious in the early stages, before the characteristic rash has appeared, and while the symptoms resemble those of a common cold.

Closure of schools :—

11. (*b.*) The second material consideration, in deciding as to the desirability of closing schools during the prevalence of infectious disease, is the amount of opportunity for intercommunication between the members of different households elsewhere than at school.

in rural districts,

In sparsely populated rural districts, where the children of different households, or of separate hamlets rarely meet except at, or on their way to, the village school, the closing of the school is likely to be effectual in checking the spread of disease. It is less likely to be useful in a town or compact village (particularly where houses are sub-let and yards are in common), where the children of different households, when not at school, spend their time in playing together, and often run in and out of each other's houses. But it must be remembered that children when at play out of doors are brought into much less close association with each other than when in school.

in populous localities,

In rural districts, where epidemic diseases are less frequently prevalent, school closing may be required as an exceptional measure to meet an exceptional state of things. As regards more populous places, it must not be forgotten, that if schools were to be closed whenever an infectious disease was prevalent, there are many places where schools would hardly ever be open.

for purposes of disinfection, &c.,

It will sometimes be necessary to close a school for a day or two to allow of the rectification of sanitary defects of a nature to extend disease, or in order that the school may be disinfected or purified. It has happened that infectious sickness in the master's family has forbidden the attendance of scholars. These more temporary and occasional closures of schools are contemplated in the Education Code, and are to be regarded as having a real importance of their own.

where many schools exist.

12. In places where there are several public elementary schools, if an outbreak of infectious disease be confined to the scholars of one particular school, it may be sufficient to close that school only. But where different schools have all appeared to aid in the spread of disease (though perhaps to an unequal extent) the sanitary authority may consider it advisable that all should be closed lest children in an infectious state who previously attended the schools that are closed, should be sent to others that might remain open.

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* Information obtainable under the Infectious Disease (Notification) Act, 1889, will be specially useful in this direction.

Sunday and private schools.

It must be remembered that sanitary authorities have no power in respect of Sunday Schools, or other private schools: except in so far as these may contravene section 91 (5), section 126, or other provision of the Public Health Act, 1875; but it will often be expedient to invite the co-operation of managers of such schools in efforts for securing the public health. Experience shows that they are usually ready to defer to the representations of the authority responsible for the public health of the district.

Duty of Medical Officer of Health as to reporting.

13. The Medical Officer of Health has not power to order the closing of a school; his function in this respect is advisory only. Reports of Medical Officers of Health to sanitary authorities, advising the closure of a school or schools in any district, are to be treated as "special" reports within the meaning of the General Order of the Local Government Board of March 23rd, 1891, and copies of them are required by Article 18 (15) and (16) of that Order to be sent to the Board, and to the County Council. These reports should state the grounds upon which the Medical Officer of Health advocates the closure of the school or schools in preference to the exclusion of particular scholars.

Grounds for action to be stated.

Notices requiring closure of schools.

14. All notices of the sanitary authority for the closing of Public Elementary Schools should be addressed in writing to the managers, and should state the grounds on which the closing is deemed necessary.

Notices to specify definite periods.

All such notices shall specify a definite time during which the school is to remain closed; this should be as short a period as can be regarded as sufficing on sanitary grounds, since a second notice may be given before the expiration of the first, if it should be found necessary to postpone the re-opening of a school. The managers of schools, after complying with the requirements of the sanitary authority, have the right of appeal to the Board of Education, if they consider any notice to be unreasonable.

W. H. POWER.

August, 1904

B.

Circular.

Councils of Metropolitan and other Boroughs, and of Urban and Rural Districts.

SEIZURE AND CONDEMNATION OF TUBERCULOUS MEAT.

Local Government Board,
Whitehall, S.W.,
7th September, 1904.

SIR,

I AM directed by the Local Government Board to state that they have had under consideration the Report of the Select Committee of the House of Commons on the Tuberculosis (Animals) Compensation Bill, 1904, in which reference is made (*a*) to the variety of practice alleged to exist with regard to the amount of tubercular deposit, the existence of which in a carcase is held to justify its total condemnation; and (*b*) to complaints made by butchers as to the injury caused to them by their prosecution in open court for having tuberculous meat upon their premises.

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With regard to (*a*) it appears to the Board to be most desirable that there should be uniformity in the practice of Meat Inspectors in dealing with the carcases of cattle; and they have already on two occasions, viz., in their Circular letters of the 11th March, 1899, and 6th September, 1901, set out, and urged the observance of, the principles laid down by the Royal Commission on Tuberculosis in their report of 1898 with respect to the degree of tubercular disease which should cause a carcase or part thereof to be seized. The Royal Commission stated as follows:—

"We are of opinion that the following principles should be observed in the inspection of tuberculous carcases of cattle:—

(*a*) When there is miliary tuberculosis of both lungs. (*b*) When tuberculous lesions are present on the pleura and peritoneum. (*c*) When tuberculous lesions are present in the muscular system, or in the lymphatic glands embedded in or between the muscles. (*d*) When tuberculous lesions exist in any part of an emaciated carcase.	The entire carcase and all the organs may be seized.
(*a*) When the lesions are confined to the lungs and the thoracic lymphatic glands. (*b*) When the lesions are confined to the liver. (*c*) When the lesions are confined to the pharyngeal lymphatic glands. (*d*) When the lesions are confined to any combination of the foregoing, but are collectively small in extent.	The carcase, if otherwise healthy, shall not be condemned, but every part of it containing tuberculous lesions shall be seized."

The Board are of opinion that, at the present time, measures more stringent than those advocated by the Royal Commission are not called for; but they would impress upon the Council the expediency and desirability of insisting upon those of their officers who are employed as Meat Inspectors acting in strict accordance with the principles thus laid down, if this is not already the case.

With regard to (*b*) the Select Committee express their view that, if a butcher who is in possession of tuberculous meat has notified the fact to the proper authority as soon as he could be reasonably expected to be aware of it, the case should not be taken into Court.

The Board understand that in some districts the course recommended by the Committee is followed now, but where this is not so the Board suggest that, having regard to the serious consequences which may result to a butcher from prosecution in open court for being in possession of tuberculous meat, the Council should act upon the view expressed by the Select Committee in cases where such possession is voluntarily and promptly disclosed by the owner.

I am, Sir,

Your obedient Servant,

S. B. PROVIS,

Secretary.

The Town Clerk, or

The Clerk to the Urban District Council, or

Rural District Council.

No. 12.

Inspection of Public Vaccination.

LIST (alphabetically arranged) of 240 UNIONS inspected during the Year 1904, with reference to the PROCEEDINGS under the VACCINATION ACTS, 1867 to 1898, and an ACCOUNT of the AWARDS certified by the Board as payable to the respective PUBLIC VACCINATORS out of COUNTY FUNDS.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Alnwick	7	6	2 6 0	13 8 0	38 19 0	Dr. Buchanan.
Amersham	6	5	3 12 0	17 2 0	38 16 0	„ Fletcher.
Ampthill	6	4	4 2 0	9 2 0	24 18 0	Do.
Ashford, East	7	5	1 10 0	6 6 0	16 0 0	„ Sweeting.
Ashford, West	4	4	1 11 0	21 3 0	32 15 0	Do.
Ashton-under-Lyne ..	11	6	5 7 0	45 7 0	131 10 0	„ Wheaton.
Atcham	7	6	4 7 0	44 17 0	73 15 0	„ Farrar.
Austell, St.	5	1	—	—	15 17 0	„ Spencer Low.
Axbridge	11	4	1 15 0	15 2 0	28 12 0	„ Manby.
Aylesbury	8	3	2 13 0	16 13 0	23 18 0	„ Fletcher.
Barnsley	10	6	6 3 0	50 2 0	111 16 0	Dr. Johnstone.
Barton Regis	2	1	—	—	8 15 0	„ Mivart.
Barton-on-Irwell ..	7	7	10 3 0	51 5 0	162 5 0	„ Wheaton.
Basingstoke	8	8	0 9 0	33 6 0	53 16 0	„ Johnstone.
Bath	5	4	3 9 0	60 4 0	90 14 0	„ Manby.
Beaminster	5	3	2 18 0	7 7 0	14 14 0	„ Bulstrode.
Bedford	8	1	—	—	3 16 0	„ Fletcher.
Belford	2	2	2 5 0	8 8 0	10 13 0	„ Buchanan.
Berwick-on-Tweed ..	3	1	—	—	3 4 0	Do.
Bethnal Green ..	2	2	20 10 0	55 4 0	75 14 0	„ Sweeting.
Beverley	6	4	1 19 0	21 3 0	32 0 0	„ Farrar.
Biggleswade	6	2	11 3 0	13 17 0	25 10 0	„ Fletcher.
Birmingham	1	1	—	—	218 14 0	„ Sweeting.
Bison	4	4	3 14 0	13 14 0	40 8 0	Do.

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UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Blofield	3	1	—	—	14 1 0	Dr. Copeman.
Bodmin	8	4	2 3 0	5 6 0	13 13 0	„ Spencer Low.
Bolton	9	9	17 10 0	152 11 0	460 5 0	„ Wheaton.
Boston	7	6	4 10 0	40 6 0	91 0 0	„ Spencer Low.
Bourne	6	3	3 19 0	11 7 0	20 13 0	Do.
Brecknock	3	2	9 13 0	12 10 0	22 3 0	„ Mivart.
Bridge	5	3	0 19 0	4 16 0	9 15 0	„ Sweeting.
Bridgwater	10	4	1 5 0	10 13 0	21 6 0	„ Manby.
Bridgnorth	3	2	2 17 0	16 16 0	19 13 0	„ Farrar.
Bridlington	4	3	1 19 0	12 12 0	17 5 0	Do.
Bridport	3	2	4 6 0	18 0 0	22 6 0	„ Bulstrode.
Brighton	2	1	—	—	50 16 0	„ Mair.
Bristol	8	6	10 0 0	48 3 0	128 6 0	„ Sweeting.
Brixworth	5	3	1 19 0	6 9 0	13 12 0	„ Mair.
Buckingham	3	2	5 18 0	10 18 0	16 16 0	„ Fletcher.
Builth	1	1	—	—	21 2 0	„ Mivart.
Burnley	7	5	0 8 0	63 11 0	136 19 0	„ Wheaton.
Bury	6	6	8 14 0	36 10 0	122 8 0	Do.
Camelford	2	1	—	—	6 3 0	Dr. Spencer Low.
Canterbury	1	1	—	—	19 5 0	„ Sweeting.
Cardiff	9	8	1 1 0	58 0 0	143 14 0	Do.
Carmarthen	6	3	7 18 0	19 18 0	43 6 0	„ Spencer Low.
Cerne	3	3	0 19 0	5 13 0	11 14 0	„ Bulstrode.
Chard	8	4	6 19 0	13 4 0	40 1 0	„ Manby.
Cheadle	5	3	9 11 0	18 0 0	39 16 0	„ Reece.
Cheltenham	3	3	3 18 0	49 1 0	59 14 0	„ Mivart.
Chipping Sodbury ..	5	2	6 1 0	6 11 0	12 12 0	Do.
Chorley	6	1	—	—	17 3 0	„ Wheaton.
Chorlton	11	9	8 3 0	55 4 0	256 6 0	Do.
Church Stretton ..	4	3	1 5 0	4 2 0	8 0 0	„ Farrar.
Cirencester	5	4	5 12 0	15 7 0	33 17 0	„ Mivart.
Cleobury Mortimer ..	2	1	—	—	9 11 0	„ Farrar.
Clitheroe	5	2	3 1 0	12 5 0	15 6 0	„ Wheaton.
Clun	4	3	1 15 0	6 6 0	12 6 0	„ Farrar.
Clutton	5	4	4 11 0	43 15 0	63 19 0	„ Manby.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Columb, St. Major ..	6	4	1 14 0	7 12 0	18 15 0	Dr. Spencer Low.
Coventry	2	2	32 2 0	165 16 0	197 18 0	„ Reece.
Cranbrook	6	6	0 14 0	4 14 0	16 10 0	„ Sweeting.
Crickhowell	5	4	4 14 0	11 11 0	36 11 0	„ Mivart.
Croydon	7	6	2 2 0	58 0 0	159 11 0	„ Farrar.
Depwade	9	9	2 3 0	10 18 0	62 16 0	Dr. Copeman.
Dewsbury	13	10	5 17 0	27 0 0	152 11 0	„ Johnstone.
Docking	4	3	5 12 0	14 17 0	26 6 0	„ Copeman.
Dolgelly	5	3	2 19 0	14 3 0	20 3 0	„ Wheaton.
Doncaster	8	7	3 17 0	61 18 0	166 14 0	„ Johnstone „ Spencer Low.
Dorchester	6	6	1 13 0	22 6 0	41 3 0	„ Bulstrode.
Dorking	5	3	1 6 0	5 15 0	11 1 0	„ Farrar.
Dover	4	—	—	—	—	„ Sweeting.
Downham	7	4	1 16 0	11 5 0	26 7 0	„ Copeman.
Drayton	5	3	2 12 0	13 10 0	20 6 0	„ Farrar.
Driffield	8	5	3 10 0	9 14 0	26 8 0	Do.
Dulverton	2	2	0 17 0	12 3 0	13 0 0	„ Manby.
Dursley	3	3	2 18 0	5 19 0	14 6 0	„ Mivart.
Eastry	7	5	2 10 0	20 6 0	39 8 0	Dr. Sweeting.
East Ward	6	3	3 15 0	4 1 0	11 17 0	„ Farrar.
Ecclesall Bierlow ..	3	3	6 12 0	129 10 0	171 11 0	„ Johnstone.
Elham	5	4	2 2 0	48 1 0	67 5 0	„ Sweeting.
Ellesmere	6	4	1 18 0	5 14 0	17 16 0	„ Farrar
Epsom	9	8	0 14 0	25 12 0	68 10 0	Do.
Eton	10	4	5 13 0	10 2 0	34 0 0	„ Fletcher.
Faith, St.	5	5	3 19 0	11 8 0	41 9 0	Dr. Copeman.
Falmouth	4	2	5 6 0	20 7 0	25 13 0	„ Spencer Low.
Festiniog	5	1	—	—	3 11 0	„ Wheaton.
Flegg, East and West	4	4	2 1 0	17 14 0	31 8 0	„ Copeman.
Foleshill	4	2	5 11 0	13 4 0	18 15 0	„ Reece.
Forehoe	5	3	2 5 0	18 18 0	27 8 0	„ Copeman.
Frome	5	5	3 1 0	22 19 0	42 13 0	„ Manby.
Fylde, The	6	3	2 15 0	13 10 0	24 11 0	„ Wheaton.

, A, No. 12.

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ors, 1904.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector
			£ s. d.	£ s. d.	£ s. d.	
Garstang	3	3	6 3 0	8 17 0	22 3 0	Dr. Wheaton.
German's, St.	6	4	2 2 0	14 1 0	31 4 0	„ Spencer Low.
Glendale	6	1	—	—	3 2 0	„ Buchanan.
Gloucester	2	2	12 4 0	38 16 0	51 0 0	„ Mivart.
Goole	4	4	3 1 0	38 12 0	56 19 0	„ Spencer Low.
Grantham	7	5	2 8 0	7 11 0	23 15 0	Do.
Hackney	5	2	78 16 0	98 3 0	176 19 0	Dr. Sweeting.
Hartley Wintney ..	7	3	7 1 0	25 16 0	40 19 0	„ Johnstone.
Haslingden	5	5	16 7 0	40 6 0	154 14 0	„ Wheaton.
Hay	3	2	4 18 0	5 14 0	10 12 0	„ Mivart.
Helston	6	4	6 6 0	8 7 0	28 18 0	„ Spencer Low.
Hemsworth	4	4	1 0	37 7 0	71 4 0	„ Johnstone.
Henstead	5	4	3 4 0	6 16 0	20 12 0	„ Copeman.
Holbeach	6	6	5 10 0	12 9 0	51 5 0	„ Johnstone.
Hollingbourn	6	5	1 8 0	6 8 0	20 15 0	„ Sweeting.
Horsham	7	6	3 18 0	12 16 0	47 10 0	„ Thomson.
Howden	4	4	3 3 0	10 5 0	25 10 0	„ Farrar.
Huddersfield	16	14	3 6 0	22 7 0	164 12 0	„ Johnstone.
Ipswich	1	1	—	—	101 0 0	Dr. Copeman.
Keighley	5	3	1 18 0	20 2 0	80 13 0	Dr. Johnstone.
Kendal	9	4	3 16 0	15 7 0	31 0 0	„ Farrar.
Keynsham	6	3	0 12 0	12 12 0	24 16 0	„ Manby.
Kingston-on-Hull ..	2	2	33 0 0	43 12 0	76 12 0	„ Farrar.
Kingston-on-Thames	15	14	2 8 0	64 7 0	226 19 0	Do.
Knighton	5	4	3 3 0	7 7 0	22 5 0	„ Mivart.
Langport	7	5	1 16 0	10 17 0	35 8 0	Dr. Manby.
Launceston	8	4	2 13 0	7 3 0	17 17 0	Spencer Low.
Leeds	7	6	0 15 0	45 11 0	135 17 0	„ Sweeting.
Leek	6	6	2 3 0	47 8 0	115 8 0	„ Reece.
Leigh	4	4	6 11 0	80 8 0	180 15 0	„ Wheaton.
Leighton Buzzard ..	2	1	—	—	2 9 0	„ Fletcher.
Lewisham	7	3	20 7 0	37 5 0	86 7 0	„ Sweeting.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Liskeard	8	4	3 3 0	11 11 0	28 12 0	Dr. Spencer Low.
Liverpool	3	3	57 14 0	128 10 0	260 14 0	„ Wheaton.
Llandilo Fawr ..	7	5	3 13 0	23 2 0	58 14 0	„ Spencer Low
Llandovery	3	2	4 7 0	10 6 0	14 13 0	Do.
Llanelly	3	1	—	—	45 12 0	Do.
Loddon and Clavering	4	3	6 17 0	11 0 0	28 0 0	„ Copeman.
Long Ashton	9	4	4 6 0	9 8 0	25 5 0	„ Manby.
Ludlow	5	5	3 2 0	16 10 0	34 17 0	„ Farrar.
Luton	5	—	—	—	—	„ Fletcher.
Madeley	4	3	9 6 0	25 13 0	57 16 0	Dr. Farrar.
Maidstone	5	5	3 5 0	57 5 0	85 2 0	„ Sweeting.
Malling	7	4	5 4 0	14 9 0	37 5 0	Do.
Manchester	3	3	39 6 0	110 9 0	231 13 0	„ Wheaton.
Meriden	3	1	—	—	3 4 0	„ Reece.
Merthyr Tydfil ..	12	9	17 0 0	120 14 0	586 5 0	„ Mivart.
Midhurst	4	4	5 7 0	16 8 0	43 19 0	„ Thomson.
Mildenhall	3	3	4 18 0	8 11 0	20 1 0	„ Copeman.
Mitford and Launditch	9	6	0 13 0	13 7 0	39 2 0	Do.
Morpeth	9	2	7 18 0	10 7 0	18 5 0	Buchanan.
Neath	6	3	26 5 0	72 7 0	127 1 0	Dr. Mivart.
Newcastle-in-Emlyn	3	2	11 17 0	22 10 0	34 7 0	„ Spencer Low.
Newcastle-under-Lyme.	3	2	1 17 0	72 9 0	74 6 0	„ Reece.
Newcastle-on-Tyne ..	4	4	42 19 0	68 12 0	207 2 0	„ Sweeting.
Newent	4	4	1 11 0	5 19 0	16 8 0	„ Mivart.
Newport (Salop) ..	4	3	4 19 0	7 9 0	19 15 0	„ Farrar.
Newport Pagnell ..	10	3	0 19 0	11 19 0	16 5 0	„ Fletcher.
Northampton	5	1	—	—	11 19 0	„ Mair.
Northleach	5	4	1 15 0	9 17 0	17 9 0	„ Mivart.
Oakham	3	1	—	—	5 1 0	Dr. Spencer Low.
Oldham	6	3	16 19 0	53 5 0	99 13 0	„ Wheaton.
Oswestry	5	5	2 7 0	28 0 0	59 16 0	„ Farrar.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union.		Total Sum awarded in each Union.	Medical Inspector.
			Minimum.	Maximum.		
			£ s. d.	£ s. d.	£ s. d.	
Patrington	5	3	2 18 0	4 18 0	11 13 0	Dr. Farrar.
Penistone	3	2	9 5 0	16 13 0	25 18 0	„ Johnstone.
Penzance	5	1	—	—	23 19 0	„ Spencer Low.
Petworth	4	4	2 5 0	15 3 0	32 12 0	„ Thomson.
Pocklington	7	3	4 10 0	4 15 0	13 15 0	„ Farrar.
Pontefract	7	5	7 8 0	63 7 0	133 9 0	„ Johnstone.
Pontypridd	14	11	20 4 0	141 5 0	651 19 0	„ Mivart.
Poole	6	5	3 1 0	16 7 0	38 19 0	„ Bulstrode.
Potterspury	4	2	3 14 0	32 0 0	35 14 0	„ Mair.
Prescot	8	5	3 12 0	120 7 0	259 9 0	„ Wheaton.
Preston	4	4	17 17 0	95 16 0	233 7 0	Do.
Prestwich	10	6	25 9 0	109 15 0	342 12 0	Do.
Redruth	6	1	—	—	15 11 0	Dr. Spencer Low
Rhayader	2	—	—	—	—	„ Mivart.
Richmond (Surrey) ..	4	2	5 0 0	13 17 0	18 17 0	„ Farrar.
Rochdale	6	3	11 2 0	86 7 0	109 7 0	„ Wheaton.
Romney Marsh ..	3	3	1 9 0	4 19 0	11 2 0	„ Sweeting.
Rothbury	6	1	—	—	2 4 0	„ Buchanan.
Rotherham	10	7	8 8 0	109 14 0	232 0 0	„ Johnstone.
Saddleworth	1	—	—	—	—	Dr. Spencer Low.
Samford	4	3	3 7 0	10 10 0	17 13 0	„ Copeman.
Sculcoates	9	6	2 3 0	69 12 0	185 9 0	„ Farrar.
Selby	4	4	0 14 0	22 16 0	31 13 0	„ Johnstone. „ Spencer Low
Sheffield	14	8	9 9 0	69 12 0	340 8 0	„ Spencer Low.
Shepton Mallet ..	5	2	3 6 0	6 16 0	10 2 0	„ Manby.
Sherborne	3	3	4 1 0	11 14 0	21 1 0	„ Bulstrode.
Shifnal	4	2	7 16 0	9 7 0	17 3 0	„ Farrar.
Skirlaugh	5	2	1 6 0	1 14 0	3 0 0	Do.
Sleaford	7	4	4 11 0	11 12 0	29 7 0	„ Spencer Low.
Smallburgh	4	4	6 11 0	17 2 0	45 18 0	„ Copeman.
Spalding	7	4	0 10 0	9 0 0	17 7 0	„ Johnstone.
Stafford	4	4	5 14 0	31 14 0	66 2 0	„ Reece.
Staines	7	4	9 12 0	29 1 0	77 19 0	„ Fletcher.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union. Minimum.	Range of Awards in each Union. Maximum.	Total Sum awarded in each Union.	Medical Inspector.
			£ s. d.	£ s. d.	£ s. d.	
Stamford	7	2	1 17 0	3 7 0	5 4 0	Dr Johnstone.
Steyning	6	4	24 18 0	54 12 0	139 5 0	„ Mair.
Stoke-on-Trent ..	5	4	13 6 0	94 6 0	251 3 0	„ Reece.
Stone	4	4	1 11 0	18 0 0	33 18 0	Do.
Stow-on-the-Wold ..	2	2	8 0 0	8 7 0	16 7 0	„ Mivart.
Stratford-on-Avon ..	7	4	1 19 0	11 11 0	19 11 0	„ Reece.
Stratton..	2	1	—	—	3 15 0	„ Spencer Low.
Stroud	6	4	3 16 0	7 9 0	19 17 0	„ Mivart.
Swaffham	5	—	—	—	—	„ Copeman.
Tadcaster	5	5	0 8 0	19 10 0	61 19 0	Dr. Johnstone.
Taunton..	7	7	2 16 0	47 14 4	93 3 0	„ Manby.
Tenterden	6	3	0 13 0	2 10 0	4 18 0	„ Sweeting.
Tetbury	2	2	4 4 0	7 0 0	11 4 0	„ Mivart.
Tewksbury	4	4	1 10 0	7 7 0	15 14 0	Do.
Thakeham	2	2	5 17 0	14 15 0	20 12 0	„ Thomson.
Thanet, Isle of ..	5	4	2 12 0	39 10 0	80 9 0	„ Sweeting.
Thetford	8	6	1 11 0	10 4 0	35 1 0	„ Copeman.
Thornbury	4	3	1 10 0	13 17 0	27 1 0	„ Mivart.
Thorne	6	3	2 16 0	7 7 0	13 7 0	„ Spencer Low.
Ticehurst	8	8	0 14 0	11 6 0	45 19 0	„ Thomson.
Towcester	4	2	3 16 0	4 1 0	7 17 0	„ Mair.
Toxteth Park	2	2	45 2 0	45 8 0	90 10 0	„ Sweeting.
Truro	7	3	3 5 0	11 13 0	23 11 0	„ Spencer Low.
Tynemouth	10	5	9 8 0	87 16 0	209 3 0	„ Buchanan.
Uppingham	4	3	4 4 0	6 12 0	16 15 0	Dr. Spencer Low.
Uttoxeter	5	2	4 0 0	7 16 0	11 16 0	„ Reece.
Walsingham	6	5	2 10 0	8 12 0	25 8 0	Dr. Copeman.
Warrington	5	5	28 7 0	82 12 0	236 17 0	„ Wheaton.
Warwick	3	2	14 0 0	18 18 0	32 18 0	„ Reece.
Wayland	5	5	2 0 0	8 4 0	23 7 0	„ Copeman.
Wellington (Salop) ..	3	1	—	—	30 3 0	„ Farrar.
Wellington (Som.) ..	6	4	4 15 0	8 4 0	25 11 0	„ Manby.
Wells	5	4	2 13 0	15 10 0	45 18 0	Do.

P. A, No. 12.

pection of
eignation,
Awards to
blic Vac-
ators, 1904.

UNION.	No. of Vaccination Districts in the Union.	No. of Public Vaccinators recommended for Award.	Range of Awards in each Union.		Total Sum awarded in each Union.	Medical Inspector.
			Minimum.	Maximum.		
			£ s. d.	£ s. d.	£ s. d.	
Wem	4	2	6 7 0	10 6 0	16 13 0	Dr. Farrar.
Westbury-on-Severn	5	5	2 0 0	11 9 0	34 11 0	„ Mivart.
West Derby	10	9	15 1 0	310 15 0	1,012 2 0	„ Wheaton.
West Ward	4	3	1 18 0	7 5 0	12 6 0	„ Farrar.
Weymouth	6	3	3 14 0	11 8 0	22 2 0	„ Bulstrode.
Wheatenhurst ..	2	2	3 1 0	3 19 0	7 0 0	„ Mivart.
Whitchurch (Salop)..	3	2	2 6 0	8 2 0	10 8 0	„ Farrar.
Wigan	11	10	10 7 0	93 14 0	368 0 0	„ Wheaton.
Wight, Isle of	10	8	1 11 0	31 2 0	100 2 0	„ Bulstrode.
Williton	7	5	0 10 0	13 18 0	23 11 0	„ Manby.
Wincanton	6	3	3 8 0	10 3 0	21 5 0	Do.
Winchcomb	2	1	—	—	9 18 0	„ Mivart.
Winchester	4	4	5 5 0	34 6 0	59 5 0	„ Johnstone.
Winslow	3	2	2 14 0	3 5 0	5 19 0	„ Fletcher.
Wortley	5	1	—	—	16 2 0	„ Johnstone.
Wycombe	11	5	1 0 0	17 7 0	43 5 0	„ Fletcher.
Yarmouth, Great ..	2	2	43 5 0	83 3 0	126 8 0	Dr. Copeman.
Yeovil	7	6	3 7 0	29 8 0	58 14 0	„ Manby.
York	9	6	2 0 0	160 7 0	175 4 0	„ Farrar.
Total	1,326	896	—	—	16,149 17 0	

No. 13.

STATISTICS OF THE NATIONAL VACCINE ESTABLISHMENT.

I.—EDUCATIONAL VACCINATION STATIONS, 1904.

In order to provide for the granting of those special certificates of proficiency in vaccination which are required to be part of the medical qualification for entering into contracts for the performance of public vaccination, or for acting as deputy to a contractor, the following arrangements are made :—

(1.) The vaccination stations enumerated in the subjoined list are open, under certain specified conditions, for the purposes of teaching and examination ;

(2.) The vaccinators officiating at these stations are authorised to give the required certificates of proficiency in vaccination to persons whom they have sufficiently instructed therein.

Cities and Towns having Educational Vaccination Stations.	Places used as Educational Vaccination Stations.	Vaccinators authorised to give Certificates of Proficiency in Vaccination after Instruction and Examination (*a*).	Days and Hours of Attendance of the Vaccinators at Stations where periodic Courses of Instructions are given (*b*).
London ...	St. Thomas's Hospital	Dr. Albert Ernest Cope, 26, Bessborough Gardens, S.W.	Wed., 11.
	Westminster Hospital	Dr. Albert Ernest Cope, 26, Bessborough Gardens, S.W.	Thursday, 11.
	Tolmers Square Institute, Drummond Street, N.W.	*Mr. Joseph Loane* ... 13, Great Alie Street, E.	Mon., Wed., 1.
	Christ Church Mission Hall, Shroton Street, Marylebone.	Mr. Edwin Climson Greenwood, 19, St. John's Wood Park, N.W.	Friday, 3.
	St. Olave's and St. John's Institute, Tooley Street, S.E.	Mr. Victor Alexander Jaynes, 157, Jamaica Road, Bermondsey, S.E.	Wed., 3.
	Eastern Dispensary, Leman Street.	Mr. Joseph Loane ... *See* above.	Wed., 11.
	New Hospital for Women, 144, Euston Road, N.W.	Miss Mary Thorne, M.D., 148, Harley Street, W.	Friday, 9.

(*a*) The vaccinators whose names are printed in *italic letters* are entitled to grant, after satisfactory examination, certificates of competency to persons whom they have not themselves instructed.

(*b*) Candidates for *Certificates* should communicate with the authorised teacher or examiner to learn the dates of his or her regular courses of instruction.

I.—EDUCATIONAL VACCINATION STATIONS—*continued.*

Cities and Towns having Educational Vaccination Stations.	Places used as Educational Vaccination Stations.	Vaccinators authorised to give Certificates of Proficiency in Vaccination after Instruction and Examination (*a*).	Days and Hours of Attendance of the Vaccinators at Stations where periodic Courses of Instructions are given (*b*).
Birmingham	Priory Rooms, Upper Priory.	*Dr. Edmund Robinson*... 213, Bristol Road, Edgbaston, Birmingham.	Monday, 1.30.
Bristol ...	St. Peter's Hospital, Bristol.	*Mr. George Shepley Page*, 78, Old Market Street, Bristol.	Wed., 11.
Cambridge..	Addenbrooke's Hospital.	Mr. Fredk. Deighton ... Hills Road, Cambridge.	Wed., 4.
Cardiff ...	Roath Church Institute, Sun Street, Roath.	*Mr. John Llewellyn Treharne*, 92, Newport Road, Cardiff.	Tuesday, 11.
Leeds ...	Leeds General Infirmary.	Mr. A. T. Bacon ... Westfield, Hyde Park Road, Leeds.	Friday, 3.
Liverpool...	177, Mulgrave Street	*Mr. Nathaniel Edward Roberts*, 17, Mulgrave Street, Liverpool.	Tuesday, 3.
Manchester	Southern Hospital for Women and Children, Manchester.	Dr. John Scott... ... 249, Upper Brook Street, Manchester.	Wed., 2.
Newcastle-on-Tyne.	The Dispensary, Nelson Street.	*Dr. Frank Hawthorn* ... 6, Regent Terrace, Newcastle-on-Tyne.	Wed., 3.
Sheffield ...	Jessop Hospital for Women.	Mr. P. E. Barber ... Leavy Greave House, Hounsfield Road, Sheffield.	Monday, 3.15.
Aberdeen...	The Public Dispensary.	*Mr. Robert Gordon McKerron*, 1, Albyn Place, Aberdeen.	Wed., 2.30.
Dundee ...	Royal Infirmary ...	Dr. Robert Cochrane Buist, 166, Nethergate, Dundee.	Thursday, 2.

(*a*) The vaccinators whose names are printed in *italic letters* are entitled to grant, after satisfactory examination, certificates of competency to persons whom they have not themselves instructed.

(*b*) Candidates for *Certificates* should communicate with the authorised teacher or examiner to learn the dates of his or her regular courses of instruction.

I.—EDUCATIONAL VACCINATION STATIONS—*continued.*

Cities and Towns having Educational Vaccination Stations.	Places used as Educational Vaccination Stations.	Vaccinators authorised to give Certificates of Proficiency in Vaccination after Instruction and Examination (*a*).	Days and Hours of Attendance of the Vaccinators at Stations where periodic Courses of Instructions are given (*b*).
Edinburgh	Livingstone Dispensary, 39, Cowgate.	*Dr. John Brown Buist*, 1, Clifton Terrace, Edinburgh.	Monday, 3.
	The Western Dispensary, Ponton Street.	*Dr. John Brown Buist*, 1, Clifton Terrace, Edinburgh.	Thursday, 3.
	The New Town Dispensary.	Dr. Francis Cadell, 22, Ainslie Place, Edinburgh.	Tuesday, 12.
	Marshall Street Dispensary.	Dr. Francis Cadell, 22, Ainslie Place, Edinburgh.	Thursday, 12.
Glasgow ...	The Royal Infirmary	Mr. H. H. Borland, 571, Alexandra Parade, Dennistoun, Glasgow.	Monday, 12 (Women); Thursday, 12 (Men).
	The Western Infirmary.	Mr. John Wyllie Nicol, 7, Kersland Terrace, Glasgow.	Monday, 12.
Belfast ...	City of Belfast Union Infirmary.	Mr. John McLiesh, 49, Great Victoria Street, Belfast.	—
Cork ...	Cork District Hospital	Dr. W. E. A. Cummins, 17, St. Patrick's Place, Cork.	—
Dublin ...	45, Upper Sackville Street.	*Dr. Alexander Nixon Montgomery*, 45, Upper Sackville Street, Dublin.	Tues., Fri., 10.

(*a*) The Vaccinators whose names are printed in *italic letters* are entitled to grant, after satisfactory examination, certificates of competency to persons whom they have not themselves instructed.

(*b*) Candidates for *Certificates* should communicate with the authorised teacher or examiner to learn the dates of his or her regular courses of instruction.

APP. A, No. 13.

National Vaccine Establishment, 1904.

II.—Animal Vaccine Station.

The Animal Vaccine Station is at 95, Lamb's Conduit Street, where Mr. T. S. Stott and Dr. Leslie Thorne Thorne attend for the Vaccination of Children on Tuesdays and Thursdays, at 10.30 a.m.

III.—Distribution of Glycerinated Calf Lymph, 1904.

Number of applications from Public Vaccinators ...	76,558
Supplies sent out :—	
Charged capillary tubes	646,120

No. 14.

REPORT on the **OPERATIONS** of the **ANIMAL VACCINE ESTABLISHMENT** at **LAMBS CONDUIT STREET** during the year 1904-5; by Mr. **THOMAS S. STOTT**, Director.

During the year April 1st, 1904, to March 31st, 1905, 155 calves were vaccinated. The aggregate weight on reception at Lambs Conduit Street of the 155 calves was 42,032 lbs. On dismissal from the station the aggregate weight was 43,630 lbs., so that during retention for vaccination purposes they gained in weight by an average of 10·3 lbs.

Of the above calves 152 were vaccinated direct from other calves, and three were vaccinated from calf lymph which had been stored. As usual, vaccinations performed with direct lymph proved to be more successful than the others.

Insertions to the number of 5,673 in calf-to-calf operations produced 5,395 vesicles, in the three calves vaccinated from lymph stored in tubes 113 insertions produced 80 vesicles; giving rates of insertion success respectively of 95·09 and 70·79 per cent.

But little difference in the results of calf-to-calf vaccinations was observed whether the lymph used was from calves vaccinated 96 hours or from calves vaccinated 120 hours previously; in either case the rate of insertion success was practically 95 per cent.

PRIMARY VACCINATIONS.

During the year 1904-5 there were performed 1,368 primary vaccinations, five separate insertions of lymph being made in each instance.

Of the persons thus vaccinated 691 were males and 677 were females.

All but 21 of the primary vaccinations succeeded at the first attempt.

There were 55 primary vaccinations performed from calf-to-arm. Of these persons primarily vaccinated by the several staff operators, on return for inspection 54 were found to have taken in five places and one in four places; the insertion success was therefore 99·63 per cent.

GLYCERINATED CALF LYMPH.

During the same period 1,313 primary vaccinations were performed with glycerinated calf lymph. Of these eight failed to return for inspection, and of the remaining 1,305 on examination 995 were found to have taken in five places, 133 in four places, 79 in three places, 42 in two places, 35 in one place, and 21 failed at the first attempt.

The insertion success was therefore 89·85 per cent.

There were nine cases brought back after inspection on account of some abnormal condition following their vaccination, and these were for the most part of a trivial character.

No. 15.

APP. A, No. 15. On the Operations of the Glycerinated Calf Lymph Establishment, 1904–05; by Dr. Blaxall.

Report on the Operations of the Glycerinated Calf Lymph Establishment, 1904–05; by Dr. Frank R. Blaxall.

During the year, smallpox continued to manifest itself both in London and the provinces in a mild and sporadic way, but the issue of lymph has been only slightly less than that of the previous year.

The amount of glycerinated calf lymph despatched during the year ending March 31st, 1905, was equivalent to 644,350 capillary tubes, each containing sufficient lymph for the vaccination of one case.

Particulars of this despatch are given in Table I. This quantity was not all issued in single charges, but some was sent out in small tubes containing sufficient lymph for the vaccination of 25, 50, or 100 cases.

The results of the use of the lymph during the year for the 598,672 cases, of which report has been sent in, show 98·4 per cent. case success, and 93·5 per cent. insertion success.

The primary vaccinations numbered 537,295, giving a case success of 98·5 per cent., and an insertion success of 93·5 per cent. The re-vaccinations numbered 61,377, giving a case success of 97·4 per cent., and an insertion success of 93·5 per cent.

Table II. shows these results for the whole year, and set out quarterly.

The lymph thus issued was derived from 456 calves.

All these animals, after slaughter, were examined by our veterinary surgeon, and certified to be healthy.

Five other calves, which appeared to be in health during the course of vaccination, were found at the autopsy to exhibit evidence of tubercular lesions. None of the lymph from these calves was issued.

The bacteriological examinations of the lymph have been carried out as heretofore, and further research in connection with calf lymph and its properties have been prosecuted. Reports of investigations on these matters will be found in Appendix C.

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Tubes.	In Tubes sufficient for 25 Vaccinations.	In Tubes sufficient for 50 Vaccinations.	In Tubes sufficient for 100 Vaccinations.

APP. A, No. 15.

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TABLE II.

Showing results of the use of GLYCERINATED CALF LYMPH issued during the year ended 31st March, 1905.

TOTAL CASES.

Period during which sent out.	Number of cases used for.	Percentage success.	
		Case.	Insertion.
June Quarter 1904	162,462	98·6	94·3
September „ „	145,184	98·2	92·5
December „ „	137,663	98·6	94·2
March „ 1905	153,363	98·3	93·2
Total	598,672	98·4	93·5

PRIMARY CASES.

Period during which sent out.	Number of cases used for.	Percentage success.	
		Case.	Insertion.
June Quarter 1904	146,700	98·8	94·3
September „ „	130,986	98·3	92·5
December „ „	118,129	98·7	94·1
March „ 1905	141,480	98·4	93·2
Total	537,295	98·5	93·5

RE-VACCINATIONS.

Period during which sent out.	Number of cases used for.	Percentage success.	
		Case.	Insertion.
June Quarter 1904	15,762	97·5	94·3
September „ „	14,198	97·1	92·3
December „ „	19,534	97·7	94·2
March „ 1905	11,883	97·3	92·9
Total	61,377	97·4	93·5

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n, 1903.

No. 16.

DIGEST of the VACCINATION OFFICERS' RETURNS with regard to Children whose Births were registered in the Year 1903.

The following is a summary of the thirty-first annual return under the Vaccination Act, 1871 :—Of 948,383 births returned to the Board by the several vaccination officers in England and Wales as registered during the year 1903, the number which, at the time the return was made, had been registered as successfully vaccinated was 714,637 (being 75·4 per cent. of the whole), and the number registered as having died unvaccinated was 91,754 (or 9·7 per cent. of the whole). Of the remaining 141,992 children, 2,573 (or 0·3 per cent. of the whole) had been registered as insusceptible of vaccination ; 17 as having contracted small-pox ; 12,489 (or 1·3 per cent.) as having their vaccination postponed by medical certificate ; and 37,675 (or 4·0 per cent.) in respect of whom certificates of conscientious objection were received ; leaving 89,238 (or 9·4 per cent.) as "removed," "not to be traced," or otherwise unaccounted for. If from the 948,383 births returned by these officers deduction be first made of the deaths that took place before vaccination, it appears that, of the surviving 856,629 children, there were registered at the time of the return 83·4 per cent. as successfully vaccinated ; 0·3 per cent. as either insusceptible of vaccination, or as having had small-pox ; 1·5 per cent. as under medical certificate of postponement ; and 4·4 per cent. in respect of whom certificates of conscientious objection to vaccination had been obtained ; leaving 10·4 per cent. as at that time still unaccounted for as regards vaccination.

The proportion of cases unaccounted for in the metropolitan returns for 1903 is 20·7 per cent. ; in the provincial returns 9·1. Of the registered births of the thirty-two years, 1872–1903, the

proportion not finally accounted for in regard to vaccination (including cases postponed) in each year respectively has been as follows :—

—	Metropolis.	Rest of England.	—	Metropolis.	Rest of England.
1872	8·8	4·5	1888	10·3	8·2
1873	8·7	4·2	1889	11·6	9·6
1874	8·8	4·1	1890	13·9	10·9
1875	9·3	3·8	1891	16·4	12·9
1876	6·5	4·0	1892	18·4	14·3
1877	7·1	4·1	1893	18·2	15·7
1878	7·1	4·3	1894	20·6	19·0
1879	7·8	4·5	1895	24·9	19·8
1880	7·0	4·5	1896	26·4	22·3
1881	5·7	4·3	1897	29·1	21·6
1882	6·6	4·5	1898	33·0	19·6
1883	6·5	4·9	1899	27·7	15·4
1884	6·8	5·3	1900	25·8	13·9
1885	7·0	5·5	1901	24·1	11·2
1886	7·8	6·1	1902	21·3	10·0
1887	9·0	6·7	1903	20·7	9·1

In 1903 the proportion of cases unaccounted for (excluding the postponed cases) in the Metropolis and in the rest of England was 19·8 and 7·7 per cent. respectively.

'P. A, No. 16.

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turns, 1903.

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
ENGLAND & WALES	948,383	714,637	2,573	17	37,675	91,754	12,489	89,238
Ditto (excluding Metropolitan Unions).	817,064	624,215	2,219	17	36,395	79,727	11,247	63,244
METROPOLITAN UNIONS	131,319	90,422	354	—	1,280	12,027	1,242	25,994
REGISTRATION DIVISIONS.								
London	131,319	90,422	354	—	1,280	12,027	1,242	25,994
South Eastern	83,700	68,022	226	—	3,487	6,290	1,067	4,608
South Midland	60,136	42,275	181	—	6,450	4,713	607	5,910
Eastern	55,567	39,862	148	1	2,719	4,566	737	7,534
South Western	44,950	35,092	93	—	2,743	3,439	942	2,641
West Midland	110,973	86,469	243	1	3,803	11,150	1,572	7,735
North Midland	61,035	36,877	91	2	6,746	6,570	880	9,869
North Western	156,421	123,330	527	9	4,298	16,978	1,722	9,557
York	105,092	80,759	445	1	3,723	11,313	1,360	7,491
Northern	73,035	57,104	180	3	1,797	8,089	1,150	4,712
Welsh†	66,155	54,425	85	—	629	6,619	1,210	3,187
REGISTRATION COUNTIES.								
ENGLAND:								
Bedford	4,087	2,058	3	—	1,200	323	35	468
Berks	6,955	5,301	13	—	226	532	141	742
Buckingham	4,647	3,234	5	—	863	321	28	196
Cambridge	5,021	4,306	12	—	107	396	49	151
Chester	22,007	18,738	86	—	164	2,131	292	596
Cornwall	7,167	5,904	8	—	228	610	125	292
Cumberland	7,646	6,193	9	—	352	757	109	226
Derby	15,122	8,784	7	—	697	1,600	243	3,791
Devon	15,415	13,089	38	—	258	1,269	284	477
Dorset	4,774	3,877	11	—	220	326	81	259
Durham	43,828	33,835	103	—	1,060	5,069	725	3,036
Essex	34,221	23,816	112	1	763	2,775	506	6,248
Gloucester	17,033	10,977	40	—	1,898	1,426	513	2,179
Hereford	2,673	2,305	1	—	41	237	17	72
Hertford	7,600	5,942	22	—	451	498	50	637
Huntingdon	1,133	980	—	—	45	76	5	27
Kent (extra-metropolitan).	24,661	20,673	96	—	778	1,955	246	913
Lancaster	134,414	104,592	441	9	4,134	14,847	1,430	8,961
Leicester	12,660	3,722	11	1	3,456	1,469	224	3,777

* The figures in this column have no reference to the other columns

† Monmouth is included in the

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated.	Exempted by "Conscientious Objection" Certificates.	Not finally accounted for, including cases postponed.	Unvaccinated.		
(1.)	(2.)	(3.)	(Cols. 2 & 3.)		
75·4	4·0	10·7	14·7	761,527	ENGLAND & WALES.
76·4	4·5	9·1	13·6	665,313	Ditto (excluding Metropolitan Union4).
68·9	1·0	20·7	21·7	96,214	METROPOLITAN UNIONS.
					REGISTRATION DIVISIONS.
68·9	1·0	20·7	21·7	96 214	London.
81·3	4·2	6·8	11·0	69,961	South Eastern.
70·3	10·7	10·8	21·5	44,240	South Midland.
71·7	4·9	14·9	19·8	40,005	Eastern.
78·1	6·1	8·0	14·1	36,618	South Western.
77·9	3·4	8·4	11·8	93,265	West Midland.
60·4	11·1	17·6	28·7	44,410	North Midland.
78·8	2·7	7·2	9·9	129,624	North Western.
76·8	3·5	8·4	11·9	90,039	York.
78·2	2·5	8·0	10·5	61,414	Northern.
82·3	1·0	6·6	7·6	55,737	Welsh.
					REGISTRATION COUNTIES.
					ENGLAND:
50·4	29·4	12·3	41·7	2,369	Bedford.
76·2	3·2	12·7	15·9	5,489	Berks.
69·6	18·6	4·8	23·4	3,321	Buckingham.
85·8	2·1	4·0	6·1	4,284	Cambridge.
85·1	0·7	4·0	4·7	19,073	Chester.
82·4	3·2	5·8	9·0	6,794	Cornwall.
81·0	4·6	4·4	9·0	6,502	Cumberland.
58·1	4·6	26·7	31·3	10,259	Derby.
84·9	1·7	4·9	6·6	13,384	Devon.
81·2	4·6	7·1	11·7	3,818	Dorset.
77·2	2·4	8·6	11·0	36,849	Durham.
69·6	2·2	19·7	21·9	24,072	Essex.
64·4	11·1	15·8	26·9	11,865	Gloucester.
86·2	1·5	3·3	4·8	2,313	Hereford.
78·2	5·9	9·0	14·9	5,896	Hertford.
86·5	4·0	2·8	6·8	995	Huntingdon.
83·8	3·2	4·7	7·9	20,730	Kent (extra-metropolitan).
77·8	3·1	7·7	10·8	110,551	Lancaster.
39·4	27·3	31·6	58·9	5,199	Leicester.

In the table, which strictly refer to the births registered in 1903.
Welsh Registration Division

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
REGISTRATION COUNTIES—*cont.*								
ENGLAND—*cont.*								
Lincoln	13,090	9,705	35	—	1,544	1,216	164	435
Middlesex (extra-metropolitan).	24,265	18,114	121	—	341	2,014	277	3,398
Monmouth	11,487	8,606	12	—	427	1,116	462	774
Norfolk	11,954	8,636	23	—	1,430	1,069	111	685
Northampton	9,119	4,345	8	—	2,958	804	118	886
Northumberland ..	20,127	15,818	66	3	365	2,158	302	1,415
Nottingham	19,736	14,307	34	1	1,029	2,256	245	1,864
Oxford	4,264	3,296	10	—	485	281	45	147
Rutland	418	359	4	—	20	29	4	2
Salop	6,868	5,941	18	—	92	561	103	153
Somerset	11,005	8,146	22	—	834	793	302	908
Southampton	19,916	17,051	35	—	461	1,473	194	702
Stafford	36,391	29,296	73	—	612	3,897	422	2,091
Suffolk	9,392	7,410	13	—	526	722	120	601
Surrey (extra-metropolitan).	18,585	15,241	57	—	613	1,341	253	1,080
Sussex	13,583	9,756	25	—	1,409	989	233	1,171
Warwick	27,803	21,013	61	—	867	3,145	320	2,397
Westmorland	1,434	1,258	2	—	20	105	14	35
Wilts	6,589	4,076	14	—	1,203	441	150	705
Worcester	20,205	16,937	50	1	203	1,884	197	843
York, E. Riding ..	13,558	11,152	34	—	154	1,426	108	684
York, N. Riding ..	11,269	8,573	17	—	414	1,312	276	677
York, W. Riding ..	80,265	61,034	394	1	3,155	8,575	976	6,130
WALES:								
Anglesey	927	805	—	—	—	98	20	4
Brecknock	1,605	1,342	1	—	14	156	27	65
Cardigan	1,392	1,217	—	—	5	133	14	23
Carmarthen	4,077	3,538	—	—	1	429	60	49
Carnarvon	3,345	2,941	3	—	9	311	32	49
Denbigh	3,017	2,637	7	—	10	202	35	36
Flint	2,504	2,186	3	—	2	203	45	65
Glamorgan	31,977	26,211	53	—	138	3,400	402	1,773
Merioneth	1,592	1,368	—	—	2	150	30	42
Montgomery	1,538	1,294	1	—	6	113	18	106
Pembroke	2,176	1,877	4	—	5	184	60	46
Radnor	518	313	1	—	10	34	5	155

* The figures in this column have no reference to the other columns

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	——
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					REGISTRATION COUNTIES—*cont.*
					ENGLAND—*cont.*
74·1	11·8	4·6	16·4	10,459	Lincoln.
74·7	1·4	15·1	16·5	19,115	Middlesex (extra-metropolitan).
75·7	3·7	10·8	14·5	9,025	Monmouth.
72·2	12·0	6·7	18·7	8,470	Norfolk.
47·6	32·4	11·0	43·4	4,826	Northampton.
78·6	1·8	8·5	10·3	16,883	Northumberland.
72·5	5·2	10·7	15·9	18,110	Nottingham
77·3	11·4	4·5	15·9	3,434	Oxford.
85·9	4·8	1·4	6·2	383	Rutland.
86·5	1·3	3·7	5·0	5,934	Salop.
74·0	7·6	11·0	18·6	8,481	Somerset.
85·6	2·3	4·5	6·8	17,476	Southampton.
80·5	1·7	6·9	8·6	52,707	Stafford.
78·9	5·6	7·7	13·3	7,463	Suffolk.
82·0	3·3	7·2	10·5	16,338	Surrey (extra-metropolitan).
71·8	10·4	10·3	20·7	9,928	Sussex.
75·6	3·1	9·8	12·9	22,740	Warwick.
87·7	1·4	3·4	4·8	1,175	Westmorland.
61·9	18·3	13·0	31·3	4,141	Wilts.
83·8	1·5	5·1	6·6	17,716	Worcester.
82·3	1·1	5·8	6·9	11,389	York, E. Riding.
76·1	3·7	8·5	12·2	8,694	York, N. Riding.
76·0	3·9	8·9	12·8	69,956	York, W. Riding.
					WALES:
86·8	—	2·6	2·6	750	Anglesey.
83·6	0·9	5·7	6·6	1,263	Brecknock.
87·4	0·4	2·7	3·1	1,096	Cardigan.
86·8	0·0	2·7	2·7	3,735	Carmarthen.
87·9	0·3	2·4	2·7	2,858	Carnarvon.
87·4	0·3	2·4	2·7	2,660	Denbigh.
87·3	0·1	4·4	4·5	2,256	Flint.
82·0	0·4	6·8	7·2	27,157	Glamorgan.
85·9	0·1	4·5	4·6	1,451	Merioneth.
84·1	0·4	8·1	8·5	1,813	Montgomery
86·8	0·2	4·9	5·1	1,832	Pembroke.
69·4	1·9	20·9	22·8	341	Radnor.

In the table, which strictly refer to the births registered in 1903.

METROPOLITAN UNIONS.	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
Bermondsey	4,232	3,074	6	—	26	462	1	663
Bethnal Green	4,633	2,036	4	—	25	511	24	2,033
Camberwell	7,310	5,121	12	—	69	582	58	1,468
Chelsea	1,509	1,154	5	—	9	141	51	149
Fulham	4,797	3,755	13	—	61	423	66	479
George's, St., Hanover 3quare.	2,240	1,929	11	—	12	188	7	93
George, St., in the East	2,170	1,413	—	—	2	156	1	596
Giles, St., and St. George	992	666	5	—	5	74	2	240
Greenwich	5,628	4,433	26	—	54	547	35	543
Hackney	7,288	4,669	21	—	90	738	66	1,704
Hammersmith	3,011	2,511	16	—	31	266	25	162
Hampstead	1,452	1,190	19	—	30	106	11	96
Holborn	4,342	3,005	5	—	16	436	19	861
Islington	8,976	6,685	23	—	103	740	62	1,363
Kensington	3,596	3,061	19	—	25	279	16	196
Lambeth	9,116	6,429	10	—	90	768	20	1,799
Lewisham	3,826	2,947	20	—	74	268	25	492
London, City of	339	266	1	—	—	32	8	32
Marylebone, St.	4,003	3,242	13	—	11	316	118	303
Mile End Old Town ..	4,480	1,469	3	—	10	330	47	2,621
Paddington	3,315	2,621	10	—	32	296	48	308
Pancras, St.	6,384	4,129	22	—	60	615	81	1,477
Poplar	5,840	2,467	7	—	21	629	18	2,698
Shoreditch	3,930	1,995	7	—	23	490	62	1,353
Southwark	6,738	4,265	10	—	50	784	28	1,601
Stepney	1,872	1,009	2	—	7	191	27	636
Strand	247	170	—	—	—	31	10	36
Wandsworth	11,723	8,616	47	—	216	1,043	293	1,508
Westminster	539	431	1	—	3	42	2	60
Whitechapel	2,857	2,337	1	—	11	232	4	272
Woolwich	3,934	3,327	15	—	114	311	17	150
	131,319	90,422	354	—	1,280	12,027	1,242	25,994

* The figures in this column have no reference to the other columns

3—continued.

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	METROPOLITAN UNIONS.
uccess-fully vacci-nated.	Exempted by "Con-scientious Objection" Certi-ficates.	Not finally accounted for, in-cluding cases postponed.	Unvacci-nated.		
(1.)	(2.)	(3.)	(Cols. 2 & 3.)		
72·6	0·6	15·7	16·3	3,399	Bermondsey.
43·9	0·5	44·4	44·9	2,412	Bethnal Green.
70·1	0·9	20·9	21·8	5,017	Camberwell.
76·5	0·6	13·3	13·9	1,289	Chelsea.
78·3	1·3	11·4	12·7	3,867	Fulham.
86·1	0·5	4·6	5·1	1,798	George's, St., Hanover Square.
65·1	0·1	27·6	27·7	1,824	George, St., in the East.
67·1	0·5	24·4	24·9	748	Giles, St., and St. George.
78·8	1·0	10·1	11·1	4,546	Greenwich.
64·1	1·2	24·3	25·5	4,961	Hackney.
83·4	1·0	6·2	7·2	2,573	Hammersmith
82·0	2·1	7·4	9·5	1,253	Hampstead.
69·2	0·4	20·3	20·7	3,206	Holborn.
74·5	1·1	15·9	17·0	6,867	Islington.
85·1	0·7	5·9	6·6	3,040	Kensington.
70·5	1·0	20·0	21·0	7,143	Lambeth.
77·0	1·9	13·5	15·4	3,086	Lewisham.
78·5	—	11·8	11·8	255	London, City of.
81·0	0·3	10·5	10·8	3,446	Marylebone, St.
33·8	0·2	59·6	59·8	1,818	Mile End Old Town.
79·1	1·0	10·7	11·7	2,710	Paddington.
64·7	0·9	24·4	25·3	4,323	Pancras, St.
42·2	0·4	46·5	46·9	2,994	Poplar.
50·8	0·6	36·0	36·6	2,101	Shoreditch.
63·3	0·7	24·2	24·9	4,503	Southwark.
53·9	0·4	35·4	35·8	1,177	Stepney.
68·8	—	18·6	18·6	193	Strand.
73·5	1·8	15·4	17·2	9,717	Wandsworth.
80·0	0·6	11·5	12·1	376	Westminster
51·8	0·4	9·7	10·1	2,405	Whitechapel
84·6	2·9	4·2	7·1	3,167	Woolwich.
68·9	1·0	20·7	21·7	96,214	

the table, which strictly refer to the births registered in 1903.

	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
BEDFORD.								
Ampthill	452	305	—	—	71	45	2	29
Bedford	1,238	789	—	—	72	105	26	246
Biggleswade	648	439	1	—	153	44	—	11
Leighton Buzzard ..	429	240	1	—	151	22	6	9
Luton	1,320	285	1	—	753	107	1	173
	4,087	2,058	3	—	1,200	323	35	468
BERKS.								
Abingdon	413	360	1	—	6	25	2	19
Bradfield	415	365	—	—	7	22	3	18
Easthampstead	370	318	3	—	3	31	2	13
Faringdon	305	252	—	—	2	22	11	18
Hungerford and Ramsbury.	373	331	—	—	7	20	8	7
Maidenhead	590	467	—	—	51	41	9	22
Newbury	433	357	—	—	35	23	9	9
Reading	2,033	1,091	4	—	76	197	71	594
Wallingford	330	291	1	—	9	23	2	4
Wantage	393	335	—	—	8	32	4	14
Windsor	863	740	1	—	14	75	15	18
Wokingham	437	394	3	—	8	21	5	6
	6,955	5,301	13	—	226	532	141	742
BUCKINGHAM.								
Amersham	599	400	—	—	118	41	1	39
Aylesbury	617	473	—	—	73	45	15	11
Buckingham	269	200	—	—	53	13	1	2
Eton	918	806	4	—	12	56	3	37
Newport Pagnell ..	752	539	—	—	145	46	3	19
Winslow	164	104	—	—	49	10	1	—
Wycombe	1,328	712	1	—	413	110	4	88
	4,647	3,234	5	—	863	321	28	196
CAMBRIDGE.								
Cambridge	881	736	3	—	13	75	7	47
Caxton and Arrington	182	169	—	—	2	11	—	—
Chesterton	785	679	2	—	18	51	9	26
Ely	480	424	—	—	15	31	6	4
Linton	223	195	3	—	2	14	4	5
Newmarket	890	766	1	—	12	65	20	26
North Witchford ..	472	410	—	—	25	30	2	5
Whittlesey	220	191	1	—	—	15	—	13
Wisbech	888	736	2	—	20	104	1	25
	5,021	4,306	12	—	107	396	49	151

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					BEDFORD.
67·5	15·7	6·9	22·6	342	Ampthill.
63·7	5·8	22·0	27·8	1,079	Bedford.
67·8	23·6	1·7	25·3	413	Biggleswade.
56·0	35·2	3·5	38·7	236	Leighton Buzzard.
21·6	57·0	13·2	70·2	299	Luton.
50·4	29·4	12·3	41·7	2,369	
					BERKS.
87·2	1·5	5·1	6·6	361	Abingdon.
88·0	1·7	5·1	6·8	367	Bradfield.
86·0	0·8	4·1	4·9	332	Easthampstead.
82·6	0·7	9·5	10·2	257	Faringdon.
88·8	1·9	4·0	5·9	348	Hungerford and Ramsbury.
79·2	8·6	5·3	13·9	497	Maidenhead.
82·4	8·1	4·2	12·3	379	Newbury.
53·7	3·7	32·7	36·4	1,120	Reading.
88·2	2·7	1·8	4·5	310	Wallingford.
85·2	2·0	4·6	6·6	318	Wantage.
85·7	1·6	3·8	5·4	814	Windsor.
90·2	1·8	2·5	4·3	386	Wokingham.
76·2	3·2	12·7	15·9	5,489	
					BUCKINGHAM.
66·8	19·7	6·7	26·4	378	Amersham.
76·7	11·8	4·2	16·0	481	Aylesbury.
74·3	19·7	1·1	20·8	220	Buckingham.
87·8	1·3	4·4	5·7	780	Eton.
71·7	19·3	2·9	22·2	508	Newport Pagnell.
63·4	29·9	0·6	30·5	98	Winslow.
53·6	31·1	6·9	38·0	856	Wycombe.
69·6	18·6	4·8	23·4	3,321	
					CAMBRIDGE
83·5	1·5	6·1	7·6	673	Cambridge.
92·9	1·1	0·0	1·1	180	Caxton and Arrington
86·5	2·3	4·5	6·8	659	Chesterton.
88·3	3·1	2·1	5·2	468	Ely.
87·4	0·9	4·0	4·9	210	Linton.
86·1	1·3	5·2	6·5	737	Newmarket.
86·9	5·3	1·5	6·8	393	North Witchford.
88·8	—	5·9	5·9	183	Whittlesey.
82·9	2·3	2·9	5·2	781	Wisbech.
85·8	2·1	4·0	6·1	4,284	

in the table, which strictly refer to the births registered in 1903.

	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
CHESTER.								
Birkenhead	5,143	4,469	32	—	4	505	42	91
Bucklow	2,025	1,813	16	—	8	160	10	18
Chester	1,413	1,205	2	—	3	127	25	51
Congleton	903	790	4	—	3	71	16	19
Macclesfield	1,398	1,218	2	—	9	130	19	18
Nantwich	2,290	1,810	9	—	38	219	44	170
Northwich	1,702	1,528	—	—	10	142	7	15
Runcorn	1,217	1,051	2	—	12	122	23	8
Stockport	4,238	3,367	10	—	73	540	93	165
Tarvin	367	332	3	—	—	25	3	4
Wirral	1,313	1,165	6	—	4	90	11	37
	22,007	18,738	86	—	164	2,131	292	596
CORNWALL.								
Austell, St.	832	736	1	—	13	65	7	10
Bodmin	403	337	2	—	8	28	3	25
Camelford	175	154	—	—	3	12	4	2
Columb Major, St. ..	361	305	1	—	5	26	14	10
Falmouth	494	380	—	—	30	46	13	25
Germans, St.	481	437	—	—	—	23	9	12
Helston	489	379	1	—	9	52	12	36
Launceston	285	246	—	—	11	19	3	6
Liskeard	493	398	—	—	46	30	12	7
Penzance	1,093	906	1	—	17	100	15	54
Redruth	1,144	885	—	—	19	149	10	81
Stratton	158	129	1	—	6	12	4	6
Truro	759	612	1	—	31	48	19	18
	7,167	5,904	8	—	228	610	126	292
CUMBERLAND.								
Alston-with-Garrigill ..	67	44	—	—	8	10	4	1
Bootle	451	384	2	—	1	50	8	6
Brampton	190	160	—	—	2	17	5	6
Carlisle	1,709	1,507	3	—	7	162	10	20
Cockermouth	2,227	1,483	4	—	258	262	71	149
Longtown	134	125	—	—	—	9	—	—
Penrith	502	451	—	—	7	43	—	1
Whitehaven	1,788	1,548	—	—	51	152	6	33
Wigton	578	493	—	—	18	52	5	10
	7,646	6,193	9	—	352	757	109	226
DERBY.								
Ashbourne	488	407	—	—	15	50	10	6
Bakewell	852	671	—	—	63	64	21	33
Belper	2,088	1,355	1	—	163	205	60	304
Chapel-en-le-Frith ..	726	624	1	—	6	57	9	29
Chesterfield	5,123	3,159	4	—	55	578	108	1,234
Derby	3,244	818	—	—	235	397	—	1,794
Glossop	603	418	—	—	98	54	18	15
Hayfield	363	317	—	—	6	29	—	11
Shardlow	1,636	1,015	1	—	56	166	22	375
	15,122	8,784	7	—	697	1,600	248	3,791

* The figures in this column have no reference to the other columns

1903 —*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					CHESTER.
86·9	0·1	2·6	2·7	4,607	Birkenhead.
89·5	0·4	1·4	1·8	1,807	Bucklow.
85·3	0·2	5·4	5·6	1,333	Chester.
87·5	0·3	3·9	4·2	885	Congleton.
87·2	0·6	2·7	3·3	1,148	Macclesfield.
79·0	1·7	9·3	11·0	2,001	Nantwich.
89·8	0·6	1·3	1·9	1,454	Northwich.
86·4	1·0	2·5	3·5	1,072	Runcorn.
79·2	1·7	6·1	7·8	3,321	Stockport.
90·5	—	1·9	1·9	331	Tarvin.
88·7	0·3	3·7	4·0	1,114	Wirral.
85·1	0·7	4·0	4·7	19,073	
					CORNWALL.
88·5	1·6	2·0	3·6	752	Austell, St.
83·6	2·0	6·9	8·9	332	Bodmin.
88·0	1·7	3·4	5·1	135	Camelford.
84·5	1·4	6·6	8·0	322	Columb Major, St.
76·9	6·1	7·7	13·8	453	Falmouth.
90·9	—	4·4	4·4	474	Germans, St.
77·5	1·8	9·8	11·6	401	Helston.
86·3	3·9	3·2	7·1	207	Launceston.
80·7	9·3	3·9	13·2	458	Liskeard.
82·9	1·6	6·3	7·9	930	Penzance.
77·4	1·7	8·0	9·7	1,475	Redruth.
81·6	3·8	6·3	10·1	171	Stratton.
80·6	8·0	4·9	12·9	684	Truro.
82·4	3·2	5·8	9·0	6,794	
					CUMBERLAND.
65·7	11·9	7·5	19·4	44	Alston-with-Garrigill.
85·1	0·2	3·1	3·3	402	Bootle.
84·2	1·1	5·8	6·9	174	Brampton.
88·2	0·4	1·8	2·2	1,501	Carlisle.
66·6	11·6	9·9	21·5	1,730	Cockermouth.
93·3	—	0·0	0·0	119	Longtown.
89·8	1·4	0·2	1·6	481	Penrith.
86·5	2·9	2·2	5·1	1,535	Whitehaven.
85·3	3·1	2·6	5·7	516	Wigton.
81·0	4·6	4·4	9·0	6,502	
					DERBY.
83·4	3·1	3·3	6·4	673	Ashbourne.
78·8	7·4	6·3	13·7	697	Bakewell.
64·9	7·8	17·4	25·2	1,430	Belper.
86·0	0·8	5·2	6·0	658	Chapel-en-le-Frith
61·7	1·1	25·9	27·0	3,694	Chesterfield.
25·2	7·2	55·3	62·5	1,299	Derby.
69·3	16·3	5·5	21·8	381	Glossop.
87·3	1·7	3·0	4·7	325	Hayfield.
62·1	3·4	24·3	27·7	1,102	Shardlow.
58·1	4·6	26·7	31·3	10,259	

in the table, which strictly refer to the births registered in 1903

	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
DEVON.								
Axminster	334	295	4	—	10	18	4	3
Barnstaple	892	734	—	—	51	66	19	22
Bideford	503	432	—	—	16	40	9	6
Crediton	314	295	—	—	1	15	—	3
Devonport	2,096	1,897	1	—	11	189	68	130
East Stonehouse ..	430	358	3	—	2	41	8	18
Exeter	839	686	—	—	16	89	9	39
Holsworthy	192	168	—	—	—	21	2	*
Honiton	442	410	—	—	5	19	3	5
Kingsbridge	337	306	—	—	4	21	1	5
Newton Abbot	1,470	1,287	5	—	36	97	29	16
Okehampton	354	309	—	—	4	16	17	8
Plymouth	2,857	2,221	17	—	36	379	56	148
Plympton St. Mary ..	523	457	—	—	2	35	5	24
South Molton	302	286	—	—	—	12	2	2
Tavistock	530	470	1	—	21	36	—	2
Thomas, St.	1,254	1,086	6	—	24	72	38	28
Tiverton	586	543	—	—	7	26	4	6
Torrington	268	243	—	—	3	17	3	2
Totnes	892	806	1	—	9	60	7	9
	15,415	13,089	38	—	258	1,269	284	477
DORSET.								
Beaminster	222	205	—	—	3	7	4	3
Blandford	255	207	—	—	4	19	3	22
Bridport	266	240	1	—	2	19	—	4
Cerne	115	92	—	—	5	13	2	3
Dorchester	458	384	1	—	1	31	8	33
Poole	942	680	5	—	86	76	39	56
Shaftesbury	274	239	—	—	7	15	5	8
Sherborne	259	223	—	—	3	20	2	11
Sturminster	179	161	—	—	4	10	—	4
Wareham and Purbeck	358	321	—	—	10	15	1	11
Weymouth	1,032	773	2	—	81	77	11	88
Wimborne and Cranborne.	414	352	2	—	14	24	6	16
	4,774	3,877	11	—	230	326	81	259
DURHAM.								
Auckland	3,601	2,552	7	—	365	408	68	201
Chester-le-Street ..	2,475	1,933	17	—	32	333	44	116
Darlington	1,673	1,205	1	—	67	228	31	141
Durham	2,653	2,076	11	—	103	304	46	114
Easington	2,105	1,837	—	—	7	204	19	38
Gateshead	6,678	4,484	2	—	165	831	71	1,125
Hartlepool	3,112	2,091	5	—	20	283	52	61
Houghton-le-Spring ..	1,661	1,346	7	—	—	204	22	82
Lanchester	3,176	2,369	7	—	121	393	122	164
Sedgefield	798	648	1	—	9	106	8	26
South Shields	6,006	4,581	18	—	40	650	95	622
Stockton	2,134	1,754	4	—	45	235	38	58
Sunderland	6,743	5,508	22	—	42	802	102	267
Teesdale	568	477	—	—	14	55	5	17
Weardale	445	374	1	—	30	33	3	4
	43,828	33,835	103	—	1,060	5,069	725	3,036

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					DEVON.
88·3	3·0	2·1	5·1	306	Axminster.
82·3	5·7	4·6	10·3	779	Barnstaple.
85·9	3·2	3·0	6·2	473	Bideford.
93·9	0·3	1·0	1·3	286	Crediton.
81·0	0·5	9·4	9·9	1,868	Devonport.
83·3	0·5	6·0	6·5	370	East Stonehouse.
81·8	1·9	5·7	7·6	722	Exeter.
87·5	—	1·6	1·6	159	Holsworthy.
93·8	1·1	1·8	2·9	413	Honiton.
90·8	1·2	1·8	3·0	506	Kingsbridge.
87·6	2·4	3·1	5·5	1,254	Newton Abbot.
87·3	1·1	7·1	8·2	296	Okehampton.
77·7	1·3	7·1	8·4	2,284	Plymouth.
87·4	0·4	5·5	5·9	422	Plympton St. Mary.
94·7	—	1·2	1·3	244	South Molton.
88·7	4·0	3·8	7·8	460	Tavistock.
86·6	1·9	5·3	7·2	1,121	Thomas, St.
92·7	1·2	1·7	2·9	566	Tiverton.
90·7	1·1	1·9	3·0	226	Torrington.
90·4	1·0	1·8	2·8	827	Totnes.
84·9	1·7	4·9	6·6	13,384	
					DORSET
93·3	1·4	3·2	4·6	184	Beaminster.
81·2	1·6	9·5	11·4	231	Blandford.
90·2	0·8	1·5	2·3	220	Bridport.
80·0	4·3	4·3	8·6	93	Cerne.
83·8	0·2	9·0	9·2	377	Dorchester.
72·2	9·1	10·1	19·2	701	Poole.
87·2	2·6	4·7	7·3	246	Shaftesbury.
86·1	1·2	5·0	6·2	211	Sherborne.
89·9	2·2	2·2	4·4	158	Sturminster.
89·7	2·8	3·4	6·2	334	Wareham and Purbeck.
74·9	7·8	9·6	17·4	778	Weymouth.
85·0	3·4	5·3	8·7	285	Wimborne and Cranborne.
81·2	4·6	7·1	11·7	3,818	
					DURHAM.
70·9	10·1	7·5	17·6	2,263	Auckland.
78·1	1·3	6·5	7·8	1,916	Chester-le-Street.
72·0	4·0	10·3	14·3	1,209	Darlington.
78·3	3·9	6·0	9·9	2,069	Durham.
87·3	0·3	2·7	3·0	1,866	Easington.
67·1	2·5	17·9	20·4	6,838	Gateshead.
86·5	0·6	3·6	4·2	2,830	Hartlepool.
81·0	—	6·3	6·3	1,513	Houghton-le-Spring.
74·6	3·8	9·0	12·8	2,280	Lanchester.
81·2	1·1	4·3	5·4	608	Sedgefield.
76·3	0·7	11·9	12·6	5,067	South Shields.
83·2	2·1	4·5	6·6	1,841	Stockton.
81·7	0·6	5·5	6·1	5,920	Sunderland.
84·0	2·5	3·9	6·4	494	Teesdale.
84·0	6·7	1·6	8·3	336	Weardale.
77·2	2·4	8·6	11·0	36,849	

in the table, which strictly refer to the births registered in 1903.

	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
DEVON.								
Axminster	334	295	4	—	10	18	4	3
Barnstaple	892	734	—	—	51	66	19	22
Bideford	503	432	—	—	16	40	9	6
Crediton	314	295	—	—	1	15	—	3
Devonport	2,096	1,697	1	—	11	189	68	130
East Stonehouse ..	430	358	3	—	2	41	8	18
Exeter	839	686	—	—	16	89	9	39
Holsworthy	192	168	—	—	—	21	2	1
Honiton	442	410	—	—	5	19	3	5
Kingsbridge	337	306	—	—	4	21	1	5
Newton Abbot	1,470	1,287	5	—	36	97	29	16
Okehampton	354	309	—	—	4	16	17	8
Plymouth	2,857	2,221	17	—	36	379	56	148
Plympton St. Mary ..	523	457	—	—	2	35	5	24
South Molton	302	286	—	—	—	12	2	2
Tavistock	530	470	1	—	21	36	—	2
Thomas, St.	1,254	1,086	6	—	24	72	38	28
Tiverton	586	543	—	—	7	26	4	6
Torrington	268	243	—	—	3	17	3	2
Totnes	892	806	1	—	9	60	7	9
	15,415	13,089	38	—	258	1,269	284	477
DORSET.								
Beaminster	222	205	—	—	3	7	4	3
Blandford	255	207	—	—	4	19	3	22
Bridport	266	240	1	—	2	19	—	4
Cerne	115	92	—	—	5	13	2	3
Dorchester	458	384	1	—	1	31	8	33
Poole	942	680	5	—	86	76	39	56
Shaftesbury	274	239	—	—	7	15	5	8
Sherborne	259	223	—	—	3	20	2	11
Sturminster	179	161	—	—	4	10	—	4
Wareham and Purbeck	358	321	—	—	10	15	1	11
Weymouth	1,032	773	2	—	81	77	11	88
Wimborne and Cranborne.	414	352	2	—	14	24	6	16
	4,774	3,877	11	—	220	326	81	259
DURHAM.								
Auckland	3,601	2,552	7	—	365	408	68	201
Chester-le-Street ..	2,475	1,933	17	—	32	333	44	116
Darlington	1,673	1,205	1	—	67	228	31	141
Durham	2,653	2,076	11	—	103	304	45	114
Easington	2,105	1,837	—	—	7	204	19	38
Gateshead	6,678	4,484	2	—	165	831	71	1,125
Hartlepool	3,112	2,691	5	—	20	283	52	61
Houghton-le-Spring ..	1,661	1,346	7	—	—	204	22	82
Lanchester	3,176	2,369	7	—	121	393	122	164
Sedgefield	798	648	1	—	9	106	8	26
South Shields	6,006	4,581	18	—	40	650	95	622
Stockton	2,134	1,754	4	—	45	235	38	58
Sunderland	6,743	5,508	22	—	42	802	102	267
Teesdale	568	477	—	—	14	55	5	17
Weardale	445	374	1	—	30	33	3	4
	43,828	33,835	103	—	1,060	5,069	725	3,036

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					DEVON.
88·3	3·0	2·1	5·1	308	Axminster.
82·3	5·7	4·6	10·3	779	Barnstaple.
85·9	3·2	3·0	6·2	473	Bideford.
93·9	0·3	1·0	1·3	286	Crediton.
81·0	0·5	9·4	9·9	1,868	Devonport.
83·3	0·5	6·0	6·5	370	East Stonehouse.
81·8	1·9	5·7	7·6	722	Exeter.
87·5	—	1·6	1·6	159	Holsworthy.
92·8	1·1	1·8	2·9	413	Honiton.
90·8	1·2	1·8	3·0	306	Kingsbridge.
87·6	2·4	3·1	5·5	1,254	Newton Abbot.
87·3	1·1	7·1	8·2	296	Okehampton.
77·7	1·3	7·1	8·4	2,284	Plymouth.
87·4	0·4	5·5	5·9	422	Plympton St. Mary.
94·7	—	1·2	1·3	244	South Molton.
88·7	4·0	3·8	7·8	460	Tavistock.
86·6	1·9	5·3	7·2	1,121	Thomas, St.
92·7	1·2	1·7	2·9	566	Tiverton.
90·7	1·1	1·9	3·0	226	Torrington.
90·4	1·3	1·8	2·8	827	Totnes.
84·9	1·7	4·9	6·6	13,384	
					DORSET
93·3	1·4	3·2	4·6	184	Beaminster.
81·2	1·6	9·8	11·4	231	Blandford.
90·2	0·8	1·5	2·3	220	Bridport.
80·0	4·3	4·3	8·6	93	Cerne.
83·8	0·2	9·0	9·2	377	Dorchester.
72·2	9·1	10·1	19·2	701	Poole.
87·2	3·6	4·7	7·3	246	Shaftesbury.
86·1	1·2	5·0	6·2	211	Sherborne.
89·9	2·2	2·2	4·4	158	Sturminster.
89·7	2·8	3·4	6·2	334	Wareham and Purbeck.
74·9	7·8	9·6	17·4	778	Weymouth.
85·0	3·4	5·3	8·7	285	Wimborne and Cranborne.
81·2	4·6	7·1	11·7	3,818	
					DURHAM.
70·9	10·1	7·5	17·6	2,262	Auckland.
78·1	1·3	6·5	7·8	1,916	Chester-le-Street.
72·0	4·0	10·3	14·3	1,209	Darlington.
78·3	3·9	6·0	9·9	2,069	Durham.
87·3	0·3	2·7	3·0	1,866	Easington.
67·1	2·5	17·9	20·4	6,838	Gateshead.
96·5	0·6	3·6	4·2	2,830	Hartlepool.
81·0	—	6·3	6·3	1,313	Houghton-le-Spring.
74·6	3·8	9·0	12·8	2,280	Lanchester.
81·2	1·1	4·3	5·4	608	Sedgefield.
76·3	0·7	11·9	12·6	5,067	South Shields.
82·2	2·1	4·5	6·6	1,841	Stockton.
81·7	0·6	5·5	6·1	5,920	Sunderland.
84·0	2·5	3·9	6·4	494	Teesdale.
84·0	6·7	1·6	8·3	336	Weardale.
77·2	2·4	8·6	11·0	36,849	

in the table, which strictly refer to the births registered in 1903.

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
ESSEX.								
Billericay	493	427	4	—	7	25	1	29
Braintree	554	478	1	—	19	32	16	8
Chelmsford	919	808	1	—	26	57	5	22
Colchester	1,021	781	1	—	23	93	15	108
Dunmow	364	329	—	—	6	22	2	5
Epping	749	652	5	—	12	48	4	28
Halstead	392	319	—	—	39	23	3	8
Lexden and Winstree ..	500	435	—	—	9	34	2	20
Maldon	613	518	—	—	28	39	5	23
Ongar	245	217	—	—	4	21	—	3
Orsett	1,175	857	—	—	79	112	35	92
Rochford	1,034	1,017	9	—	148	118	45	297
Romford	3,427	2,841	15	1	67	244	9	250
Saffron Walden ..	330	288	—	—	8	20	3	11
Tendring	1,177	1,008	1	—	33	74	20	41
West Ham	20,628	12,841	75	—	255	1,813	341	5,303
	34,221	23,816	112	1	763	2,775	506	6,248
GLOUCESTER.								
Barton Regis	405	323	—	—	6	21	29	26
Bristol	9,279	6,297	33	—	206	893	244	1,606
Cheltenham	1,253	742	4	—	302	93	39	73
Chipping Sodbury ..	462	398	—	—	13	26	4	21
Cirencester	449	375	—	—	23	37	2	12
Dursley	284	184	1	—	53	19	15	12
Gloucester	1,563	607	1	—	592	116	115	132
Newent	198	159	—	—	13	9	2	15
Northleach	212	172	—	—	20	16	1	3
Stow-on-the-Wold ..	198	153	—	—	32	10	1	2
Stroud	830	368	1	—	203	53	28	177
Tetbury	146	103	—	—	26	10	—	7
Tewkesbury	297	156	—	—	68	28	—	45
Thornbury	436	372	—	—	9	30	10	15
Westbury-on-Severn ..	647	322	—	—	255	46	4	20
Wheatenhurst	124	71	—	—	18	8	19	8
Winchcomb	250	175	—	—	59	11	—	5
	17,033	10,977	40	—	1,898	1,426	513	2,179
HEREFORD.								
Bromyard	236	208	—	—	2	23	—	3
Dore	181	160	—	—	8	10	—	3
Hereford	838	717	—	—	6	89	7	19
Kington	225	204	—	—	1	14	—	6
Ledbury	315	257	—	—	9	25	3	21
Leominster	303	272	—	—	4	23	3	1
Ross	403	339	—	—	11	32	4	17
Weobley	172	148	1	—	—	21	—	2
	2,673	2,305	1	—	41	237	17	72

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					ESSEX.
86·6	1·4	6·1	7·5	436	Billericay.
86·3	3·4	4·3	7·7	463	Braintree.
87·9	2·8	2·9	5·7	819	Chelmsford.
76·5	2·3	12·0	14·3	867	Colchester.
90·4	1·6	1·9	3·5	320	Dunmow.
87·0	1·6	4·3	5·9	648	Epping.
81·4	9·9	2·8	12·7	304	Halstead.
87·0	1·8	4·4	6·2	412	Lexden and Winstree.
84·5	4·6	4·6	9·2	450	Maldon.
88·6	1·6	1·2	2·8	191	Ongar.
72·9	6·7	10·8	17·5	920	Orsett.
62·2	9·1	20·9	30·0	1,071	Rochford.
82·9	2·0	7·6	9·6	2,960	Romford.
87·3	2·4	4·2	6·6	291	Saffron Walden.
85·6	2·8	5·2	8·0	992	Tendring.
62·3	1·2	27·4	28·6	12,988	West Ham.
69·6	2·2	19·7	21·9	24,072	
					GLOUCESTER.
79·8	1·5	13·6	15·1	431	Barton Regis.
67·9	2·2	19·9	22·1	6,785	Bristol.
59·2	24·1	8·9	33·0	693	Cheltenham.
86·1	2·8	5·4	8·2	380	Chipping Sodbury.
83·5	5·1	3·1	8·2	422	Cirencester.
64·8	18·7	9·5	28·2	136	Dursley.
38·8	37·9	15·8	53·7	1,011	Gloucester.
80·3	6·6	8·6	15·2	133	Newent.
81·1	9·4	1·9	11·3	154	Northleach.
77·3	16·2	1·5	17·7	106	Stow-on-the-Wold.
44·3	24·5	24·7	49·2	280	Stroud.
70·5	17·8	4·8	22·6	98	Tetbury.
52·5	22·9	15·2	38·1	170	Tewkesbury.
85·3	2·1	5·7	7·8	336	Thornbury.
49·8	39·4	3·7	43·1	338	Westbury-on-Severn.
57·3	14·5	21·8	36·3	92	Wheatenhurst.
70·0	23·6	2·0	25·6	190	Winchcomb.
64·5	11·1	15·8	26·9	11,855	
					HEREFORD.
88·1	0·8	1·3	2·1	218	Bromyard.
88·4	4·4	1·7	6·1	156	Dore.
85·6	0·7	3·1	3·8	717	Hereford.
90·7	0·4	2·7	3·1	205	Kington.
81·6	2·9	7·6	10·5	265	Ledbury.
89·8	1·3	1·3	2·6	260	Leominster.
84·1	2·7	5·2	7·9	321	Ross.
86·0	—	1·2	1·2	171	Weobley.
86·2	1·5	3·3	4·8	2,313	

in the table, which strictly refer to the births registered in 1903.

Digest of Vaccination Officers' Returns, 1903.

	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
HERTFORD.								
Albans, St.	866	564	3	—	184	48	—	67
Barnet	1,590	1,213	10	—	40	114	9	204
Berkhampstead ..	329	253	1	—	36	22	9	8
Bishop Stortford ..	517	453	—	—	6	34	4	20
Buntingford	118	103	1	—	1	8	—	5
Hatfield	215	188	—	—	—	15	—	10
Hemel Hempstead ..	410	302	—	—	60	34	4	10
Hertford	422	387	—	—	3	22	2	8
Hitchin	712	610	1	—	28	47	4	24
Royston	357	328	—	—	6	19	—	4
Ware	510	444	1	—	7	32	6	20
Watford	1,493	1,063	3	—	82	98	11	246
Welwyn	63	44	2	—	—	5	1	11
	7,600	5,942	22	—	451	498	50	637
HUNTINGDON.								
Huntingdon	472	396	—	—	22	39	3	12
Ives, St.	321	289	—	—	7	16	2	7
Neots, St.	340	295	—	—	16	21	—	8
	1,133	980	—	—	45	76	5	27
KENT (EXTRA-METROPOLITAN).								
Ashford, East	330	279	—	—	23	21	3	4
Ashford, West	511	414	—	—	29	38	4	26
Blean	592	493	5	—	20	41	5	28
Bridge	271	236	3	—	3	22	3	4
Bromley	2,158	1,834	12	—	37	169	19	57
Canterbury	511	439	5	—	3	38	6	20
Cranbrook	287	240	1	—	7	23	—	16
Dartford	3,114	2,676	13	—	79	242	22	82
Dover	1,338	1,191	2	—	18	102	6	19
Eastry	700	631	—	—	13	48	3	5
Elham	1,308	1,104	9	—	30	117	10	38
Faversham	702	622	3	—	9	48	5	15
Gravesend and Milton	728	589	—	—	12	66	15	46
Hollingbourn	286	237	—	—	6	22	6	15
Hoo	91	82	—	—	1	5	—	3
Maidstone	1,212	966	3	—	99	104	9	31
Malling	774	677	1	—	12	60	4	20
Medway	2,990	2,564	11	—	68	266	18	63
Milton	813	678	—	—	27	76	6	26
Romney Marsh	169	153	—	—	2	12	1	2
Sevenoaks	710	608	3	—	16	44	15	24
Sheppey	571	465	2	—	26	53	6	19
Strood	1,263	1,075	10	—	23	94	20	41
Tenterden	201	164	—	—	11	14	5	7
Thanet, Isle of	1,502	1,145	5	—	134	124	12	82
Tonbridge	1,529	1,112	8	—	70	106	43	190
	24,661	20,673	96	—	778	1,955	246	913

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					HERTFORD.
65·1	21·2	7·7	28·9	557	Albans, St.
76·3	2·5	13·4	15·9	1,156	Barnet.
76·9	10·9	5·2	16·1	266	Berkhampstead.
87·6	1·2	4·6	5·8	454	Bishop Stortford.
87·3	0·8	4·2	5·0	104	Buntingford.
88·3	—	4·7	4·7	177	Hatfield.
73·7	14·6	3·4	18·0	341	Hemel Hempstead.
91·7	0·7	2·4	3·1	382	Hertford.
85·7	3·7	3·9	7·6	583	Hitchin.
91·9	1·7	1·1	2·8	299	Royston.
87·1	1·4	5·1	6·5	483	Ware.
70·5	5·5	17·2	22·7	1,028	Watford.
69·8	—	19·0	19·0	63	Welwyn.
78·2	5·9	9·0	14·9	5,896	
					HUNTINGDON.
83·9	4·7	3·2	7·9	400	Huntingdon.
90·0	2·2	2·8	5·0	307	Ives, St.
86·8	4·7	2·4	7·1	288	Neots, St.
86·5	4·0	2·8	6·8	995	
					KENT (EXTRA-METROPOLITAN).
84·5	7·0	2·1	9·1	199	Ashford, East.
81·0	5·7	5·9	11·6	420	Ashford, West.
83·3	3·4	5·6	9·0	510	Blean.
87·1	1·1	2·6	3·7	249	Bridge.
85·0	1·7	4·9	6·6	1,897	Bromley.
85·9	0·6	5·1	5·7	378	Canterbury.
83·6	2·4	5·6	8·0	253	Cranbrook.
85·9	2·5	3·3	5·8	2,547	Dartford.
89·0	1·3	1·9	3·2	1,203	Dover.
90·1	1·9	1·1	3·0	652	Eastry.
84·4	2·3	3·7	6·0	1,099	Elham.
88·6	1·3	2·8	4·1	583	Faversham.
80·9	1·6	8·4	10·0	597	Gravesend and Milton.
82·9	2·1	7·3	9·4	229	Hollingbourn.
90·1	1·1	3·3	4·4	88	Hoo.
79·7	8·2	3·3	11·5	1,016	Maidstone.
87·5	1·6	3·1	4·7	702	Malling.
85·8	2·3	2·7	5·0	2,550	Medway.
83·4	3·3	3·9	7·2	637	Milton.
89·9	1·2	1·8	3·0	131	Romney Marsh.
85·6	2·3	5·5	7·8	586	Sevenoaks.
81·4	4·6	4·4	9·0	465	Sheppey.
85·1	1·8	4·8	6·6	1,136	Strood.
81·6	5·5	6·0	11·5	155	Tenterden.
76·2	8·9	6·3	15·2	1,223	Thanet, Isle of.
72·7	4·6	15·2	19·8	1,225	Tonbridge.
83·8	3·2	4·7	7·9	20,730	

in the table, which strictly refer to the births registered in 1903.

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
LANCASTER.								
Ashton-under-Lyne ..	4,567	2,994	7	—	238	592	79	657
Barrow-in-Furness ..	1,970	1,795	5	—	13	124	9	24
Barton-upon-Irwell ..	3,280	2,652	14	—	22	319	85	188
Blackburn	5,734	4,841	27	5	166	542	26	127
Bolton	7,362	6,576	16	—	63	661	12	34
Burnley	5,185	2,682	13	—	912	759	197	622
Bury	3,362	2,254	9	—	462	377	41	219
Chorley	1,797	1,589	6	—	9	164	12	37
Chorlton	10,383	7,318	25	—	42	1,235	147	1,616
Clitheroe	507	417	1	—	3	52	15	19
Fylde, The	2,538	2,009	13	—	66	247	39	164
Garstang	306	280	1	—	9	13	2	1
Haslingden	2,627	2,076	13	—	198	296	45	61
Lancaster	1,678	1,418	4	—	10	152	13	81
Leigh	3,047	2,566	6	—	21	350	16	88
Liverpool	5,211	4,395	31	—	1	651	8	145
Lunesdale	147	136	—	—	—	11	—	—
Manchester	4,433	3,123	5	—	5	630	68	602
Oldham	5,560	2,804	8	—	1,189	782	—	777
Ormskirk	2,482	2,117	16	—	17	261	7	74
Prescot	5,544	4,842	14	—	3	514	23	148
Preston	4,430	3,457	12	—	11	504	44	302
Prestwich	6,384	5,229	14	—	56	608	21	456
Rochdale	2,869	2,006	1	—	428	308	58	93
Salford	7,637	5,994	25	—	34	946	118	530
Todmorden	885	678	—	—	83	98	4	22
Toxteth Park	4,036	3,131	33	—	3	461	64	344
Ulverston	1,097	995	4	—	2	79	8	9
Warrington	3,725	3,232	30	1	11	351	27	73
West Derby	18,406	15,046	88	1	16	1,989	177	1,109
Wigan	7,235	5,970	10	2	41	866	87	259
	134,414	104,592	441	9	4,134	14,847	1,430	8,961
LEICESTER.								
Ashby-de-la-Zouch ..	1,626	963	—	—	337	149	—	277
Barrow-on-Soar ..	725	256	—	—	344	74	6	45
Billesdon	127	93	1	—	18	11	2	2
Blaby	666	155	—	—	417	56	9	29
Hinckley	715	298	—	—	320	62	5	30
Leicester	6,018	678	9	1	992	899	166	3,273
Loughborough	980	388	—	—	437	86	25	44
Lutterworth	251	191	—	—	28	21	1	12
Market Bosworth ..	556	283	—	—	231	39	1	22
Market Harborough ..	443	255	—	—	141	22	8	17
Melton Mowbray ..	553	282	1	—	193	50	1	26
	12,660	3,722	11	1	3,456	1,469	224	3,777
LINCOLN.								
Boston	1,036	788	1	—	130	96	3	18
Bourne	449	351	—	—	9	42	5	42
Caistor	351	255	1	—	55	26	1	13
Gainsborough	1,004	588	2	—	306	71	2	35
Glanford Brigg	1,538	752	1	—	571	128	25	61
Grantham	836	683	14	—	36	61	8	34

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated.	Exempted by "Conscientious Objection" Certificates.	Not finally accounted for, including cases postponed.	Unvaccinated.		
(1.)	(2.)	(3.)	(Cols. 2 & 3.)		
					LANCASTER.
65·6	5·2	16·1	21·3	3,556	Ashton-under-Lyne.
91·1	0·7	1·7	2·4	1,737	Barrow-in-Furness.
80·9	0·7	8·3	9·0	2,502	Barton-upon-Irwell.
84·4	2·9	2·7	5·6	4,890	Blackburn.
89·3	0·9	0·6	1·5	6,533	Bolton.
51·7	17·6	15·8	33·4	2,827	Burnley.
67·0	13·7	7·7	21·4	2,488	Bury.
87·3	0·5	2·7	3·2	1,545	Chorley.
70·5	0·4	17·0	17·4	7,192	Chorlton.
82·2	0·6	6·7	7·3	468	Clitheroe.
79·2	2·6	8·0	10·6	2,084	Fylde, The.
91·5	2·9	1·0	3·9	147	Garstang.
79·0	7·5	4·0	11·5	2,056	Haslingden.
84·5	0·6	5·6	6·2	1,434	Lancaster.
84·2	0·7	3·4	4·1	2,568	Leigh.
84·1	0·0	2·9	2·9	4,641	Liverpool.
92·5	—	0·0	0·0	149	Lunesdale.
70·4	0·1	15·1	15·2	3,400	Manchester.
50·4	21·4	14·0	35·4	3,599	Oldham.
85·3	0·7	3·3	4·0	2,283	Ormskirk.
87·3	0·1	3·1	3·2	5,049	Prescot.
78·2	0·2	9·9	10·1	4,927	Preston.
81·9	0·9	7·5	8·4	5,239	Prestwich.
69·9	14·9	4·6	19·5	2,089	Rochdale.
78·5	0·4	8·4	8·8	6,721	Salford.
76·6	9·4	2·9	12·3	962	Todmorden.
77·6	0·1	10·1	10·2	3,364	Toxteth Park.
90·7	0·2	1·5	1·7	941	Ulverston.
86·8	0·3	2·7	3·0	3,716	Warrington.
81·7	0·1	7·0	7·1	15,631	West Derby.
82·5	0·6	4·8	5·4	5,813	Wigan.
77·8	3·1	7·7	10·8	110,551	
					LEICESTER.
53·1	20·7	17·0	37·7	921	Ashby-de-la-Zouch.
35·3	47·4	7·0	54·4	339	Barrow-on-Soar.
73·2	14·2	3·1	17·3	83	Billesdon.
23·3	62·6	5·7	68·3	186	Blaby.
41·7	44·8	4·9	49·7	373	Hinckley.
11·3	16·5	57·1	73·6	1,051	Leicester.
39·6	44·6	7·0	51·6	1,027	Loughborough.
78·1	10·4	5·2	15·6	190	Lutterworth.
47·3	41·5	4·1	45·6	269	Market Bosworth.
57·6	31·8	5·6	37·4	311	Market Harborough.
51·0	34·9	4·9	39·8	449	Melton Mowbray.
29·4	27·3	31·6	58·9	5,199	
					LINCOLN.
76·1	12·5	2·0	14·5	813	Boston.
78·2	2·0	10·5	12·5	341	Bourne.
72·6	15·7	4·0	19·7	229	Caistor.
58·6	30·5	3·7	34·2	629	Gainsborough.
56·2	27·7	6·4	34·1	770	Glanford Brigg.
81·7	4·3	5·0	9·3	686	Grantham.

in the table, which strictly refer to the births registered in 1903.

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
LINCOLN—*cont.*								
Grimsby	2,519	1,985	3	—	93	296	52	90
Holbeach	495	338	—	—	106	42	3	6
Horncastle	414	349	1	—	5	34	1	24
Lincoln	1,878	1,422	4	—	166	197	27	62
Louth	842	501	1	—	54	49	24	13
Sleaford	600	492	1	—	42	54	6	5
Spalding	550	336	1	—	146	48	5	14
Spilsby	559	510	5	—	4	37	—	3
Stamford	428	355	—	—	21	35	2	15
	13,099	9,705	35	—	1,544	1,216	164	435
MIDDLESEX (EXTRA-METROPOLITAN).								
Brentford	5,931	4,627	26	—	40	496	55	687
Edmonton	10,578	7,293	51	—	123	858	155	1,898
Hendon	1,510	1,303	10	—	56	106	6	29
Staines	1,090	896	1	—	14	89	2	86
Uxbridge	1,286	1,082	—	—	19	109	21	55
Willesden	4,070	2,911	33	—	89	356	38	643
	24,285	18,114	121	—	341	2,014	277	3,398
MONMOUTH.								
Abergavenny	806	580	—	—	78	78	—	70
Bedwellty	3,801	2,786	1	—	46	384	199	385
Chepstow	500	379	—	—	62	40	—	19
Monmouth	796	596	—	—	112	52	12	24
Newport	3,910	3,035	8	—	84	399	196	188
Pontypool	1,674	1,320	3	—	45	163	55	88
	11,487	8,696	12	—	427	1,116	462	774
NORFOLK.								
Aylsham	444	389	—	—	18	35	1	1
Blofield	253	232	—	—	4	16	—	1
Depwade	539	454	5	—	13	39	4	24
Docking	425	389	1	—	20	26	2	7
Downham	419	370	1	—	6	27	6	9
Erpingham	602	450	1	—	59	53	16	23
Faith, St.	322	244	—	—	37	26	4	11
Flegg, East and West	399	258	1	—	9	20	5	6
Forehoe	290	253	—	—	12	22	1	2
Freebridge Lynn	289	243	—	—	3	10	1	12
Henstead	253	224	—	—	7	16	—	5
King's Lynn	506	61	—	—	18	57	7	363
Loddon and Clavering	296	266	—	—	5	19	4	2
Mitford and Launditch	534	428	1	—	13	63	7	22
Norwich	3,197	1,862	4	—	1,009	393	7	122
Smallburgh	437	341	2	—	27	49	7	11
Swaffham	232	178	1	—	10	9	26	8
Thetford	455	382	—	—	41	25	1	6
Walsingham	469	399	—	—	33	15	4	18
Wayland	316	277	—	—	9	19	1	10
Yarmouth, Great	1,398	1,156	6	—	77	130	7	22
	11,954	8,636	23	—	1,430	1,069	111	685

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					LINCOLN—*cont.*
78·8	3·7	5·6	9·3	2,418	Grimsby.
68·3	21·4	1·8	23·2	364	Holbeach.
84·3	1·2	6·0	7·2	332	Horncastle.
75·7	8·8	4·7	13·5	1,594	Lincoln.
78·0	8·4	5·8	14·2	524	Louth.
82·0	7·0	1·8	8·8	481	Sleaford.
61·1	26·5	3·5	30·0	416	Spalding.
91·2	0·7	0·5	1·2	533	Spilsby.
82·9	4·9	4·0	8·9	329	Stamford.
74·1	11·8	4·6	16·4	10,459	
					MIDDLESEX. (EXTRA-METROPOLITAN).
78·0	0·7	12·5	13·2	4,766	Brentford.
70·3	1·2	19·8	21·0	7,631	Edmonton
86·3	3·7	2·3	6·0	1,354	Hendon.
82·4	1·3	8·1	9·4	945	Staines.
84·1	1·5	5·9	7·4	1,169	Uxbridge.
71·5	2·2	16·7	18·9	3,250	Willesden.
74·7	1·4	15·1	16·5	19,115	
					MONMOUTH.
72·0	9·7	8·7	18·4	561	Abergavenny.
73·3	1·2	15·4	16·6	3,103	Bedwellty.
75·8	12·4	3·8	16·2	367	Chepstow.
74·9	14·1	4·5	18·6	621	Monmouth.
77·6	2·1	9·8	11·9	3,072	Newport.
78·9	2·7	8·5	11·2	1,301	Pontypool.
75·7	3·7	10·8	14·5	9,025	
					NORFOLK.
87·6	4·1	0·5	4·6	353	Aylsham.
91·7	1·6	0·4	2·0	214	Blofield.
84·2	2·4	5·2	7·6	451	Depwade.
86·8	4·7	2·1	6·8	372	Docking.
88·3	1·4	3·6	5·0	369	Downham.
74·8	9·8	6·5	16·3	434	Erpingham.
75·8	11·5	4·7	16·2	237	Faith, St.
86·3	3·0	3·7	6·7	225	Flegg, East and West.
87·2	4·1	1·0	5·1	243	Forehoe.
90·3	1·1	4·8	5·9	229	Freebridge Lynn.
88·9	2·8	2·0	4·8	199	Henstead.
12·1	3·6	73·1	76·7	68	King's Lynn.
89·9	1·7	2·0	3·7	252	Loddon and Clavering.
80·1	2·4	5·4	7·8	392	Mitford and Launditch.
52·0	31·6	4·0	35·6	1,685	Norwich.
78·0	6·2	4·1	10·3	338	Smallburgh.
76·7	4·3	14·7	19·0	142	Swaffham.
84·0	9·0	1·5	10·5	399	Thetford.
85·1	7·0	4·7	11·7	396	Walsingham.
87·7	2·8	3·5	6·3	258	Wayland.
82·7	5·5	2·1	7·6	1,217	Yarmouth, Great.
72·2	12·0	6·7	18·7	8,470	

in the table, which strictly refer to the births registered in 1903.

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
NORTHAMPTON.								
Brackley	237	157	—	—	25	13	1	41
Brixworth	295	197	—	—	54	19	1	24
Daventry	407	298	—	—	57	24	5	23
Hardingstone	329	183	—	—	108	24	1	13
Kettering	1,361	333	—	—	576	122	66	264
Northampton	2,220	665	3	—	1,082	239	8	223
Oundle	236	197	—	—	12	20	3	4
Peterborough	1,427	1,108	3	—	52	120	15	129
Potterspury	372	248	—	—	95	17	—	12
Thrapston	394	181	—	—	166	35	3	9
Towcester	231	120	—	—	58	27	4	22
Wellingborough	1,610	658	2	—	673	144	11	122
	9,119	4,345	8	—	2,958	804	118	886
NORTHUMBERLAND.								
Alnwick	648	541	—	—	7	53	17	30
Belford	126	112	8	—	—	5	—	1
Bellingham	128	106	—	—	1	9	1	11
Berwick-upon-Tweed	460	401	—	—	—	40	8	11
Castle Ward	1,172	582	5	—	38	82	47	418
Glendale	192	181	—	—	—	9	1	1
Haltwhistle	218	155	—	—	41	19	—	3
Hexham	904	734	5	—	56	67	13	29
Morpeth	2,215	1,650	6	—	41	290	66	162
Newcastle-on-Tyne ..	7,758	6,374	12	—	50	845	29	448
Rothbury	167	145	—	—	1	15	—	6
Tynemouth	6,139	4,837	30	3	130	724	120	295
	20,127	15,818	66	3	365	2,158	302	1,415
NOTTINGHAM.								
Basford	5,400	3,828	7	—	413	584	7	561
Bingham	320	273	1	—	16	24	1	5
East Retford	670	554	2	—	37	54	2	21
Mansfield	3,528	2,296	1	—	78	476	174	503
Newark	852	719	8	—	30	73	9	13
Nottingham	6,950	5,032	13	1	411	830	35	628
Southwell	446	356	—	—	12	53	7	18
Worksop	1,570	1,249	2	—	32	162	10	115
	19,736	14,307	34	1	1,029	2,256	245	1,864
OXFORD.								
Banbury	642	335	—	—	224	48	11	24
Bicester	258	203	1	—	16	21	5	12
Chipping Norton ..	390	247	—	—	102	17	4	20
Headington	828	731	2	—	12	50	4	29
Henley	639	511	3	—	48	47	8	22
Oxford	501	442	—	—	3	34	1	21
Thame	267	229	—	—	13	20	4	1
Witney	465	381	3	—	40	30	5	6
Woodstock	274	217	1	—	27	14	3	12
	4,264	3,296	10	—	485	281	45	147

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					NORTHAMPTON.
66·2	10·5	17·7	28·2	129	Brackley.
66·8	18·3	8·5	26·8	151	Brixworth.
73·2	14·0	6·9	20·9	247	Daventry.
55·6	32·8	4·3	37·1	181	Hardingstone.
24·5	42·3	24·2	66·5	700	Kettering.
30·0	48·7	10·4	59·1	641	Northampton.
83·5	5·1	3·0	8·1	209	Oundle.
77·6	3·6	10·1	13·7	1,210	Peterborough.
66·7	25·5	3·2	28·7	259	Potterspury.
45·9	42·1	3·0	45·1	239	Thrapston.
51·9	25·1	11·3	36·4	89	Towcester.
40·9	41·8	8·3	50·1	771	Wellingborough.
47·6	32·4	11·0	43·4	4,826	
					NORTHUMBERLAND.
83·5	1·1	7·3	8·4	504	Alnwick.
88·9	—	0·8	0·8	108	Belford.
82·8	0·8	9·4	10·2	117	Bellingham.
87·2	—	4·1	4·1	387	Berwick-upon-Tweed.
49·7	3·2	39·7	42·9	945	Castle Ward.
94·3	—	1·0	1·0	160	Glendale.
71·1	18·8	1·4	20·2	163	Haltwhistle.
81·2	6·2	4·6	10·8	755	Hexham.
74·5	1·9	10·3	12·2	1,746	Morpeth.
82·2	0·6	6·1	6·7	6,736	Newcastle-on-Tyne.
86·8	0·6	3·6	4·2	114	Rothbury.
78·8	2·1	6·8	8·9	5,153	Tynemouth.
78·6	1·8	8·5	10·3	16,888	
					NOTTINGHAM.
70·9	7·6	10·5	18·1	3,992	Basford.
85·3	5·0	1·9	6·9	270	Bingham.
82·7	5·5	3·4	8·9	543	East Retford.
65·1	2·2	19·2	21·4	3,556	Mansfield.
84·4	3·5	2·6	6·1	700	Newark.
72·4	5·9	9·5	15·4	7,322	Nottingham.
79·8	2·7	5·6	8·3	393	Southwell.
79·6	2·0	8·0	10·0	1,334	Worksop.
72·5	5·2	10·7	15·9	18,110	
					OXFORD.
52·2	34·9	5·5	40·4	390	Banbury.
78·7	6·2	6·6	12·8	172	Bicester.
63·3	26·3	6·2	32·4	247	Chipping Norton.
88·3	1·4	4·0	5·4	820	Headington.
80·0	7·5	4·7	12·2	554	Henley.
88·2	0·6	4·4	5·0	422	Oxford.
85·8	4·9	1·9	6·8	236	Thame.
81·9	8·6	2·4	11·0	351	Witney.
79·2	9·9	5·5	15·4	242	Woodstock
77·3	11·4	4·5	15·9	3,434	

in the table, which strictly refer to the births registered in 1903.

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
RUTLAND.								
Oakham	231	197	4	—	18	14	3	—
Uppingham	187	162	—	—	7	15	1	2
	418	359	4	—	20	29	4	2
SALOP.								
Atcham	1,232	1,062	8	—	5	105	17	35
Bridgnorth	380	324	1	—	9	37	2	7
Church Stretton ..	141	130	—	—	1	8	1	1
Cleobury Mortimer ..	229	203	1	—	4	15	1	5
Clun	203	177	1	—	7	11	1	6
Drayton	362	311	—	—	1	36	—	4
Ellesmere	338	304	—	—	2	24	2	6
Ludlow	480	423	—	—	12	28	10	8
Madeley	735	649	—	—	7	57	16	6
Newport	332	295	2	—	2	24	6	5
Oswestry	786	688	—	—	4	74	10	10
Shifnal	284	237	1	—	3	23	11	9
Wellington	808	658	—	—	15	81	18	36
Wem	277	240	—	—	6	22	1	6
Whitchurch	291	243	4	—	12	16	7	9
	6,868	5,941	18	—	92	561	103	153
SOMERSET.								
Axbridge	967	579	2	—	212	73	23	78
Bath	1,764	1,233	5	—	136	133	132	115
Bridgwater	870	474	2	—	35	72	45	242
Chard	596	525	1	—	6	44	6	14
Clutton	803	647	3	—	68	45	11	29
Dulverton	104	92	—	—	4	7	1	—
Frome	489	382	—	—	62	29	6	10
Keynsham	1,072	641	1	—	31	86	23	290
Langport	318	273	—	—	3	34	3	5
Long Ashton	517	415	1	—	36	29	4	32
Shepton Mallet	338	289	1	—	31	19	3	15
Taunton	897	761	3	—	33	75	8	17
Wellington	414	340	—	—	38	24	2	10
Wells	524	408	1	—	44	40	17	14
Williton	348	299	1	—	12	19	10	7
Wincanton	338	294	1	—	9	24	1	9
Yeovil	656	514	—	—	74	40	7	21
	11,005	8,146	22	—	834	793	302	908
SOUTHAMPTON.								
Alresford	148	134	—	—	2	9	—	3
Alton	430	367	1	—	2	34	2	14
Alverstoke	854	767	1	—	4	48	7	27
Andover	406	296	—	—	67	25	6	12
Basingstoke	554	443	1	—	36	41	14	19
Catherington	59	55	—	—	—	1	—	3
Christchurch	1,356	1,021	2	—	29	105	35	164
Droxford	291	267	1	—	2	17	1	3
Fareham	557	500	1	—	9	31	—	16
Fordingbridge	170	138	—	—	17	7	—	8

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					RUTLAND.
85·3	5·6	1·3	6·9	201	Oakham.
86·6	3·7	1·6	5·3	182	Uppingham.
85·9	4·8	1·4	6·2	383	
					SALOP.
86·2	0·4	4·2	4·6	1,186	Atcham.
85·3	2·4	2·4	4·8	337	Bridgnorth.
92·2	0·7	1·4	2·1	113	Church Stretton.
88·6	1·7	2·6	4·3	193	Cleobury Mortimer.
87·2	3·4	3·4	6·8	178	Clun.
88·4	0·3	1·1	1·4	354	Drayton.
89·9	0·6	2·4	3·0	310	Ellesmere.
87·9	2·5	3·7	6·2	373	Ludlow.
88·3	1·0	3·0	4·0	622	Madeley.
88·3	0·6	3·3	3·9	283	Newport.
87·5	0·5	2·5	3·0	669	Oswestry.
83·5	1·1	7·0	8·1	254	Shifnal.
81·4	1·9	6·7	8·6	585	Wellington.
86·6	2·9	2·5	5·4	243	Wem.
83·5	4·1	5·5	9·6	234	Whitchurch.
86·5	1·3	3·7	5·0	5,934	
					SOMERSET
59·9	21·9	10·4	32·3	631	Axbridge.
70·3	7·8	14·1	21·9	1,352	Bath.
54·5	4·0	33·0	37·0	449	Bridgwater.
88·1	1·0	3·4	4·4	528	Chard.
80·6	8·5	5·0	13·5	649	Clutton.
88·5	3·8	1·0	4·8	84	Dulverton.
78·1	12·7	3·3	16·0	352	Frome.
59·8	2·9	29·2	32·1	590	Keynsham.
85·8	0·9	2·5	3·4	208	Langport.
80·3	7·0	7·0	14·0	510	Long Ashton.
79·6	9·2	5·3	14·5	294	Shepton Mallet.
84·8	3·7	2·8	6·5	816	Taunton.
82·1	9·2	2·9	12·1	311	Wellington.
77·9	8·4	5·9	14·3	493	Wells.
85·9	3·4	4·9	8·3	323	Williton.
87·0	2·7	3·0	5·7	255	Wincanton.
78·4	11·3	4·3	15·6	536	Yeovil.
74·0	7·6	11·0	18·6	8,481	
					SOUTHAMPTON.
90·5	1·4	2·0	3·4	129	Alresford.
87·4	0·5	3·8	4·3	360	Alton.
89·8	0·5	4·0	4·5	756	Alverstoke.
72·9	16·5	4·4	20·9	288	Andover.
80·0	6·5	6·0	12·5	420	Basingstoke.
93·2	—	5·1	5·1	59	Catherington
75·3	2·1	14·7	16·8	1,138	Christchurch.
91·8	0·7	1·4	2·1	252	Droxford.
89·8	1·6	2·9	4·5	436	Fareham.
81·2	10·0	4·7	14·7	119	Fordingbridge.

in the table, which strictly refer to the births registered in 1903.

	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
SOUTHAMPTON—*cont.*								
Hartley Wintney ..	757	665	1	—	9	57	6	19
Havant	269	234	—	—	1	18	—	16
Hursley	95	85	—	—	—	3	6	1
Kingsclere	208	188	—	—	9	10	1	—
Lymington	284	254	—	—	2	10	2	16
New Forest	374	327	2	—	—	25	2	18
Petersfield	299	260	—	—	7	12	3	17
Portsmouth	5,448	4,831	12	—	50	471	23	59
Ringwood	170	149	—	—	7	11	2	1
Romsey	284	225	—	—	5	16	3	5
Southampton	1,697	1,445	6	—	22	150	12	62
South Stoneham ..	2,536	2,139	4	—	36	187	40	130
Stockbridge	128	107	—	—	7	12	—	2
Whitchurch	146	126	—	—	3	13	—	4
Wight, Isle of	1,694	1,390	3	—	101	106	25	69
Winchester	734	628	—	—	34	54	4	14
	19,916	17,051	35	—	461	1,473	194	702
STAFFORD.								
Burton-on-Trent ..	2,657	2,067	3	—	109	195	1	282
Cannock	1,692	1,508	1	—	26	129	8	20
Cheadle	724	643	—	—	4	55	10	12
Leek	1,308	1,077	1	—	65	116	30	19
Lichfield	1,289	1,115	1	—	9	107	13	44
Newcastle-under-Lyme	1,311	1,130	3	—	4	134	12	26
Seisdon	446	373	1	—	12	36	5	19
Stafford	799	678	1	—	26	67	4	23
Stoke-upon-Trent ..	5,596	4,342	7	—	17	709	137	384
Stone	485	429	—	—	1	29	5	1
Tamworth	814	668	—	—	7	94	14	31
Uttoxeter	414	335	—	—	2	32	15	30
Walsall	4,324	3,333	13	—	49	543	40	346
West Bromwich ..	5,648	4,521	23	—	117	635	83	269
Wolstanton and Burslem	3,760	3,097	8	—	5	452	10	188
Wolverhampton ..	5,144	3,980	11	—	159	564	35	395
	36,391	29,296	73	—	612	3,897	422	2,091
SUFFOLK.								
Blything	650	590	—	—	7	46	2	5
Bosmere and Claydon ..	364	317	—	—	8	18	4	17
Bury St. Edmunds ..	410	337	3	—	22	29	5	14
Cosford	359	316	1	—	5	28	4	5
Hartismere	343	312	—	—	1	17	2	11
Hoxne	251	221	—	—	2	19	1	8
Ipswich	1,957	1,030	2	—	365	224	35	301
Mildenhall	190	174	1	—	—	10	3	2
Mutford and Lothingland	1,419	1,080	2	—	40	112	26	179
Plomesgate	452	392	—	—	5	37	11	7
Risbridge	402	368	—	—	7	21	2	4
Samford	282	260	1	—	4	24	2	1
Stow	486	423	—	—	23	27	3	10
Sudbury	575	497	—	—	17	38	8	15
Thingoe	331	304	1	—	5	16	1	4
Wangford	336	306	1	—	5	16	4	2
Woodbridge	585	511	1	—	10	40	7	16
	9,392	7,410	13	—	526	722	120	601

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					SOUTHAMPTON—*cont.*
87·8	1·2	3·3	4·5	720	Hartley Wintney.
87·0	0·4	5·9	6·3	170	Havant.
89·5	—	7·4	7·4	85	Hursley.
90·4	4·3	0·5	4·8	202	Kingsclere.
89·4	3·7	6·3	7·0	244	Lymington.
87·4	—	5·3	5·3	305	New Forest.
87·0	2·3	6·7	9·0	215	Petersfield.
88·7	0·9	1·5	2·4	4,932	Portsmouth.
87·6	4·1	1·8	5·9	157	Ringwood.
89·0	1·9	3·0	4·9	241	Romsey.
85·2	1·3	4·4	5·7	1,474	Southampton.
84·3	1·4	6·7	8·1	2,405	South Stoneham.
83·6	5·5	1·6	7·1	116	Stockbridge.
86·3	2·1	2·7	4·8	126	Whitchurch.
82·1	6·0	5·5	11·5	1,489	Wight, Isle of.
85·6	4·6	2·5	7·1	638	Winchester.
85·6	2·3	4·5	6·8	17,476	
					STAFFORD.
77·8	4·1	10·7	14·8	2,087	Burton-on-Trent.
89·1	1·5	1·7	3·2	1,579	Cannock.
88·8	0·6	3·0	3·6	682	Cheadle.
82·3	5·0	3·7	8·7	1,131	Leek.
86·5	0·7	4·4	5·1	1,151	Lichfield.
86·2	0·3	3·1	3·4	1,211	Newcastle-under-Lyme.
83·6	2·7	5·4	8·1	377	Seisdon.
84·9	3·3	3·4	6·7	755	Stafford.
77·6	0·3	9·3	9·6	4,670	Stoke-upon-Trent.
92·3	0·2	1·3	1·5	453	Stone.
82·1	0·9	5·5	6·4	783	Tamworth.
80·9	0·5	10·9	11·4	426	Uttoxeter.
77·1	1·1	8·9	10·0	3,923	Walsall.
80·0	2·1	6·2	8·3	4,862	West Bromwich.
82·4	0·1	5·3	5·4	3,300	Wolstanton and Burslem.
77·4	3·1	8·4	11·5	5,317	Wolverhampton.
80·5	1·7	6·9	8·6	32,707	
					SUFFOLK.
90·8	1·1	1·1	2·2	566	Blything.
87·1	2·2	5·8	8·0	250	Bosmere and Claydon.
82·2	5·4	4·6	10·0	328	Bury St. Edmunds.
88·0	1·4	2·5	3·9	328	Cosford.
91·0	0·3	3·8	4·1	272	Hartismere.
88·0	0·8	3·6	4·4	254	Hoxne.
52·6	18·7	17·2	35·9	989	Ipswich.
91·6	—	2·6	2·6	192	Mildenhall.
74·7	2·8	14·4	17·2	1,062	Mutford and Lothingland.
86·7	1·1	4·0	5·1	395	Plomesgate.
91·5	1·7	1·5	3·2	397	Risbridge.
88·7	1·4	1·1	2·5	270	Samford.
87·0	4·7	2·7	7·4	386	Stow.
86·4	3·0	4·0	7·0	534	Sudbury.
91·8	1·5	1·5	3·0	314	Thingoe.
91·7	1·5	1·8	3·3	366	Wangford.
87·4	1·7	3·9	5·6	560	Woodbridge.
78·9	5·6	7·7	13·3	7,463	

in the table, which strictly refer to the births registered in 1903.

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	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
SURREY (EXTRA-METROPOLITAN).								
Chertsey	1,036	878	4	—	16	68	19	51
Croydon	5,341	4,286	27	—	206	399	65	358
Dorking	392	289	—	—	53	30	6	14
Epsom	1,409	1,121	1	—	13	86	60	128
Farnham	1,748	1,533	7	—	18	128	3	59
Godstone	698	585	—	—	5	50	9	49
Guildford	1,475	1,150	4	—	117	92	31	81
Hambledon	498	440	3	—	10	27	4	14
Kingston	3,835	3,146	9	—	69	292	48	271
Reigate	946	752	1	—	95	68	5	25
Richmond..	1,207	1,061	1	—	11	101	3	30
	18,585	15,241	57	—	613	1,341	253	1,080
SUSSEX.								
Battle	523	442	2	—	29	31	2	17
Brighton	2,425	1,732	8	—	108	238	29	310
Chichester	253	225	—	—	2	15	1	10
Cuckfield	554	471	2	—	21	36	13	11
Eastbourne	1,078	336	1	—	364	76	38	263
East Grinstead	451	278	—	—	78	25	26	44
East Preston	866	720	1	—	24	55	10	56
Hailsham	404	237	—	—	120	29	4	14
Hastings	1,205	892	4	—	95	93	8	113
Horsham	650	525	—	—	20	55	9	41
Lewes	485	284	1	—	133	33	5	30
Midhurst	312	276	—	—	2	18	5	11
Newhaven	299	165	1	—	108	15	—	10
Petworth	198	178	—	—	4	16	—	—
Rye	274	211	1	—	34	23	1	4
Steyning	1,925	1,452	2	—	121	129	45	176
Thakeham	192	174	—	—	2	8	2	6
Ticehurst	323	264	—	—	31	13	1	14
Uckfield	538	336	1	—	111	41	27	22
Westbourne	161	141	—	—	1	14	—	5
Westhampnett	467	417	1	—	2	36	7	14
	13,383	9,736	35	—	1,409	999	233	1,171
WARWICK.								
Alcester	474	403	1	—	20	40	5	6
Aston	10,432	7,916	17	—	20	1,289	117	1,043
Atherstone	903	573	—	—	4	58	39	104
Birmingham	7,988	6,138	13	—	15	1,067	31	642
Coventry	3,199	1,909	4	—	155	185	79	41
Foleshill	462	338	—	—	24	53	—	7
Meriden	262	198	—	—	4	16	4	38
Nuneaton..	1,018	533	—	—	288	117	—	68
Rugby	965	466	5	—	70	291	36	113
Solihull	1,485	1,208	5	—	24	108	1	85
Southam	242	196	1	—	19	14	6	19
Stratford-on-Avon ..	462	375	—	—	21	63	6	12
Warwick	1,108	828	3	—	40	98	6	32
	27,800	21,013	61	—	887	3,145	329	2,397

* The figures in this column have no reference to the other columns.

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated.	Exempted by "Conscientious Objection" Certificates.	Not finally accounted for, including cases postponed.	Unvaccinated.		
(1.)	(2.)	(3.)	(Cols. 2 & 3.)		
					SURREY (EXTRA-METROPOLITAN).
84·7	1·5	6·8	8·3	911	Chertsey.
80·2	3·9	7·9	11·8	4,913	Croydon.
73·7	13·5	5·1	18·6	287	Dorking.
79·6	0·9	13·3	14·2	1,273	Epsom.
87·7	1·0	3·5	4·5	1,509	Farnham.
83·8	0·7	8·3	9·0	561	Godstone.
78·0	7·9	7·6	15·5	1,292	Guildford.
88·4	2·0	3·6	5·6	440	Hambledon.
82·0	1·8	8·3	10·1	3,303	Kingston.
79·5	10·0	3·2	13·2	771	Reigate.
87·9	0·9	2·7	3·6	1,078	Richmond.
82·0	3·3	7·2	10·5	16,338	
					SUSSEX.
84·5	5·5	3·6	9·1	418	Battle.
71·4	4·5	14·0	18·5	1,779	Brighton.
88·9	0·8	4·3	5·1	231	Chichester.
85·0	3·8	4·3	8·1	474	Cuckfield.
31·2	33·8	27·9	61·7	330	Eastbourne.
61·6	17·3	15·5	32·8	257	East Grinstead.
89·1	2·8	7·6	10·4	722	East Preston.
58·7	29·7	4·5	34·2	267	Hailsham.
74·0	7·9	10·0	17·9	1,065	Hastings.
80·8	3·1	7·7	10·8	532	Horsham.
58·6	27·2	7·2	34·4	289	Lewes.
88·5	0·6	5·1	5·7	284	Midhurst.
55·2	36·1	3·3	39·4	107	Newhaven.
89·9	2·0	0·0	2·0	157	Petworth.
77·0	12·4	1·8	14·2	251	Rye.
75·4	6·3	11·5	17·8	1,412	Steyning.
90·6	1·0	4·2	5·2	158	Thakeham.
81·7	9·6	4·6	14·2	271	Ticehurst.
62·5	20·6	9·1	29·7	301	Uckfield.
87·6	0·6	3·1	3·7	156	Westbourne.
89·3	0·4	4·5	4·9	407	Westhampnett.
71·8	10·4	10·3	20·7	9,928	
					WARWICK.
85·0	4·2	2·3	6·5	463	Alcester.
75·9	0·6	11·1	11·7	8,302	Aston.
61·9	6·6	22·2	28·8	372	Atherstone.
77·7	3·1	8·4	11·5	6,744	Birmingham.
76·9	8·9	5·5	14·4	2,263	Coventry.
81·3	9·7	1·1	10·8	539	Foleshill.
81·8	1·7	9·9	11·6	198	Meriden.
50·6	29·3	8·6	37·9	405	Nuneaton.
47·2	7·3	36·9	44·2	553	Rugby.
85·4	0·9	5·8	6·7	1,309	Solihull.
81·0	7·9	5·0	12·9	197	Southam.
81·2	4·5	5·0	9·5	361	Stratford-on-Avon.
84·1	3·6	2·7	6·3	1,034	Warwick.
75·6	3·1	9·8	12·9	22,740	

in the table, which strictly refer to the births registered in 1903,

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
WESTMORLAND.								
East Ward	288	233	—	—	15	23	2	15
Kendal	944	852	2	—	5	65	7	13
West Ward	202	173	—	—	—	17	5	7
	1,434	1,258	2	—	20	105	14	35
WILTS.								
Amesbury	214	182	—	—	20	4	2	6
Bradford-on-Avon ..	232	93	—	—	23	13	—	103
Calne	209	157	—	—	2	14	23	33
Chippenham	570	303	1	—	88	35	—	143
Cricklade and Wootton Bassett.	300	160	1	—	87	26	11	15
Devizes	415	251	1	—	106	45	8	4
Malmesbury	268	193	—	—	25	21	10	19
Marlborough	213	185	2	—	8	10	3	5
Mere	124	108	—	—	1	6	9	—
Pewsey	304	253	1	—	21	17	5	7
Salisbury	658	467	3	—	113	28	21	26
Swindon and Highworth.	1,829	930	3	—	622	153	52	70
Tisbury	166	152	—	—	3	7	1	3
Trowbridge and Melksham.	405	96	—	—	18	33	—	258
Warminster	245	217	—	—	10	14	—	4
Westbury and Whorwellsdown.	222	173	1	—	30	10	1	7
Wilton	215	176	1	—	26	6	4	2
	6,589	4,076	14	—	1,203	441	150	705
WORCESTER.								
Bromsgrove	992	865	2	—	15	92	8	10
Droitwich	477	410	—	—	3	35	3	26
Dudley	5,505	4,654	13	—	37	550	49	202
Evesham	508	382	1	—	82	45	3	15
Kidderminster	1,036	909	1	—	15	77	10	24
King's Norton	5,406	4,509	21	1	69	479	50	337
Martley	315	283	—	—	1	27	1	3
Pershore	309	282	1	—	3	16	2	5
Shipston-on-Stour ..	305	294	—	—	28	30	3	10
Stourbridge	3,185	2,819	5	—	7	302	13	39
Tenbury	186	164	—	—	1	12	5	4
Upton-on-Severn ..	577	501	2	—	22	40	2	10
Worcester	1,284	885	4	—	10	179	48	158
	20,205	16,937	50	1	293	1,884	197	843
YORK, EAST RIDING.								
Beverley	625	540	—	—	20	49	—	16
Bridlington	489	389	2	—	26	44	1	27
Driffield	457	382	2	—	16	40	5	6
Howden	347	293	1	—	7	34	2	10
Kingston-upon-Hull ..	2,374	1,831	8	—	9	285	11	230
Patrington	226	198	—	—	7	21	—	—
Pocklington	349	303	—	—	4	34	7	1
Sculcoates	5,784	4,752	14	—	37	657	54	270
Skirlaugh	245	228	—	—	—	14	—	3
York	2,662	2,236	7	—	28	242	28	121
	13,558	11,152	34	—	154	1,426	108	684

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					WESTMORLAND.
80·9	5·2	5·9	11·1	214	East Ward.
90·3	0·5	2·1	2·6	792	Kendal.
85·6	—	5·9	5·9	169	West Ward.
87·7	1·4	3·4	4·8	1,175	
					WILTS.
85·0	9·3	3·7	13·0	198	Amesbury.
40·1	9·9	44·4	54·3	97	Bradford-on-Avon.
65·6	1·0	26·8	27·8	125	Calne.
53·2	15·4	25·1	40·5	306	Chippenham.
58·3	29·0	8·7	37·7	121	Cricklade and Wootton Bassett.
61·5	25·5	2·9	28·4	246	Devizes.
72·0	9·3	10·8	20·1	220	Malmesbury.
86·9	3·8	3·8	7·6	144	Marlborough.
87·1	0·8	7·3	8·1	111	Mere.
83·2	6·9	3·9	10·8	248	Pewsey.
71·0	17·2	7·1	24·3	500	Salisbury.
50·8	34·0	6·7	40·7	989	Swindon and Highworth.
91·6	1·8	2·4	4·2	175	Tisbury.
23·7	4·4	63·7	68·1	114	Trowbridge and Melksham.
88·6	4·1	1·6	5·7	198	Warminster.
77·9	13·5	3·6	17·1	169	Westbury and Whorwellsdown.
81·9	12·1	2·8	14·9	180	Wilton.
61·9	18·3	13·0	31·3	4,141	
					WORCESTER.
87·2	1·5	1·8	3·3	865	Bromsgrove.
86·0	0·6	6·1	6·7	436	Droitwich.
84·5	0·7	4·6	5·3	4,940	Dudley.
71·3	16·1	3·5	19·6	379	Evesham.
87·7	1·4	3·3	4·7	927	Kidderminster.
83·5	1·3	7·1	8·4	4,928	King's Norton.
89·8	0·3	1·3	1·6	256	Martley.
91·3	1·0	2·3	3·3	251	Pershore.
80·5	7·7	3·6	11·3	306	Shipston-on-Stour.
88·5	0·2	1·8	1·8	2,774	Stourbridge.
88·2	0·5	4·8	5·3	138	Tenbury.
86·8	3·8	2·1	5·9	495	Upton-on-Severn.
68·9	0·8	16·0	16·8	1,011	Worcester.
83·8	1·5	5·1	6·6	17,716	
					YORK, EAST RIDING.
86·4	3·2	2·6	5·8	489	Beverley.
79·6	5·3	5·7	11·0	394	Bridlington.
83·6	3·5	2·4	5·9	374	Driffield.
84·4	2·0	3·5	5·5	300	Howden.
77·1	0·4	10·2	10·6	1,886	Kingston-upon-Hull.
97·6	3·1	0·0	3·1	146	Patrington.
86·8	1·1	2·3	3·4	269	Pocklington.
82·2	0·6	5·6	6·2	4,949	Sculcoates.
98·1	—	1·2	1·2	239	Skirlaugh.
84·0	1·1	5·6	6·7	2,323	York.
82·3	1·1	5·8	6·9	11,389	

in the table, which strictly refer to the births registered in 1903.

Digest of Vaccination Officers' Returns, 1903.

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
YORK, NORTH RIDING.								
Aysgarth	111	98	1	—	5	5	1	1
Bedale	202	178	—	—	5	16	—	3
Easingwold	215	191	—	—	1	16	2	5
Guisborough	1,293	1,053	2	—	34	134	21	49
Helmsley	131	113	—	—	—	15	—	3
Kirkby Moorside ..	111	103	—	—	1	6	—	1
Leyburn	140	127	1	—	3	6	—	3
Malton	544	463	—	—	16	51	6	5
Middlesbrough	5,340	3,925	5	—	23	772	167	448
Northallerton	302	258	—	—	14	21	1	8
Pickering	254	205	—	—	11	26	8	4
Reeth	45	39	—	—	—	3	1	2
Richmond..	297	260	1	—	—	26	6	4
Scarborough	1,184	592	7	—	265	140	56	124
Stokesley	235	206	—	—	10	15	1	3
Thirsk	328	294	—	—	4	20	2	8
Whitby	537	468	—	—	22	37	4	6
	11,269	8,573	17	—	414	1,312	276	677
YORK, WEST RIDING.								
Barnsley	4,697	3,899	31	—	26	547	38	156
Bierley, North	2,967	2,325	8	—	141	288	46	159
Bradford	5,414	3,986	15	—	300	635	51	427
Bramley	2,323	1,882	14	—	62	251	41	73
Dewsbury	4,352	2,707	9	—	493	537	112	494
Doncaster	2,806	2,152	10	—	101	360	85	98
Ecclesall Bierlow ..	5,632	4,624	51	—	32	610	30	285
Goole	861	758	1	—	5	91	1	5
Halifax	4,175	1,399	3	—	58	412	28	2,275
Hemsworth	1,044	867	1	—	8	111	7	50
Holbeck	1,147	905	1	—	25	143	17	56
Huddersfield	3,954	3,393	33	—	87	313	37	91
Hunslet	2,777	2,264	10	—	46	343	8	106
Keighley	1,738	508	—	—	946	148	17	119
Knaresborough	1,063	786	1	—	57	92	49	78
Leeds	7,437	5,796	41	1	98	813	87	601
Ouseburn, Great ..	252	218	2	—	8	19	—	5
Pateley Bridge	184	167	—	—	1	10	2	4
Penistone	496	416	2	—	—	45	17	16
Pontefract	2,851	2,137	4	—	57	319	114	220
Ripon	374	330	—	—	6	27	2	9
Rotherham	4,305	3,775	27	—	15	409	18	61
Saddleworth	411	287	—	—	66	48	1	9
Sedbergh	70	57	—	—	3	5	1	4
Selby	502	444	1	—	4	41	2	10
Settle	344	285	1	—	17	25	3	13
Sheffield	9,055	7,380	97	—	47	1,090	34	407
Skipton	1,111	607	3	—	315	100	42	44
Tadcaster	996	872	7	—	8	89	1	19
Thorne	466	347	1	—	28	53	9	28
Wakefield	3,697	3,161	7	—	52	348	18	111
Wetherby	330	287	1	—	1	24	9	8
Wharfedale	1,268	1,046	6	—	37	117	13	49
Wortley	1,166	967	6	—	5	112	36	40
	80,265	61,034	394	1	3,155	8,575	976	6,130

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					YORK, NORTH RIDING
88·3	4·5	1·8	6·3	100	Aysgarth.
88·1	2·5	1·5	4·0	182	Bedale.
88·8	0·5	3·3	3·8	192	Easingwold.
81·4	2·6	5·4	8·0	1,123	Guisborough.
86·3	—	2·3	2·3	91	Helmsley.
92·8	0·9	0·9	1·8	125	Kirkby Moorside.
90·7	2·1	2·1	4·2	129	Leyburn.
85·1	2·9	2·0	4·9	433	Malton.
73·5	0·4	11·5	11·9	3,950	Middlesbrough.
85·4	4·6	3·0	7·6	295	Northallerton.
80·7	4·3	4·7	9·0	235	Pickering.
86·7	—	6·7	6·7	37	Reeth.
87·5	—	3·4	3·4	292	Richmond.
50·0	22·4	15·2	37·6	581	Scarborough
87·7	4·3	1·7	6·0	242	Stokesley.
89·2	1·2	3·0	4·2	275	Thirsk.
87·2	4·1	1·9	6·0	442	Whitby.
76·1	3·7	8·5	12·2	8,694	
					YORK, WEST RIDING
83·0	0·6	4·1	4·7	4,139	Barnsley.
78·4	4·8	6·9	11·7	2,426	Bierley, North.
73·6	5·5	8·8	14·3	3,881	Bradford.
81·0	2·7	4·9	7·6	1,851	Bramley.
62·2	11·3	13·9	25·2	8,983	Dewsbury.
76·7	3·6	6·5	10·1	2,434	Doncaster.
82·1	0·6	5·6	6·2	4,893	Ecclesall Bierlow.
88·0	0·6	0·7	1·3	731	Goole.
33·5	1·4	55·2	56·6	2,430	Halifax.
83·0	0·8	5·5	6·3	934	Hemsworth.
78·9	2·2	6·4	8·6	1,053	Holbeck.
85·8	2·2	3·2	5·4	3,447	Huddersfield.
81·5	1·7	4·1	5·8	2,259	Hunslet.
29·2	54·4	7·8	62·2	543	Keighley.
73·9	5·4	11·9	17·3	811	Knaresborough.
77·9	1·3	9·3	10·6	5,868	Leeds.
86·5	3·2	2·0	5·2	231	Ouseburn, Great.
90·8	0·5	3·3	3·8	169	Pateley Bridge.
83·9	—	6·7	6·7	443	Penistone.
75·0	2·0	11·7	13·7	2,100	Pontefract.
88·2	1·8	2·9	4·5	323	Ripon.
87·7	0·3	1·8	2·1	3,899	Rotherham.
69·8	16·1	2·4	18·5	301	Saddleworth.
81·4	4·3	7·1	11·4	59	Sedbergh.
88·4	0·8	2·4	3·2	458	Selby.
82·8	4·9	4·7	9·6	326	Settle.
81·5	0·5	4·9	5·4	7,558	Sheffield.
54·6	28·4	7·7	36·1	826	Skipton.
87·6	0·8	2·0	2·8	838	Tadcaster.
74·5	6·0	7·9	13·9	372	Thorne.
85·5	1·4	3·5	4·9	2,961	Wakefield.
87·0	0·3	5·2	5·5	329	Wetherby.
82·5	2·9	4·9	7·8	1,099	Wharfedale.
82·9	0·4	6·5	6·9	981	Wortley.
76·0	3·9	8·9	12·8	69,956	

in the table, which strictly refer to the births registered in 1903.

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
ANGLESEY.								
Anglesey	352	304	—	—	—	45	—	3
Holyhead	575	501	—	—	—	53	20	1
	927	805	—	—	—	98	20	4
BRECKNOCK.								
Brecknock	412	367	—	—	1	39	1	4
Builth	227	181	—	—	2	15	13	16
Crickhowell	760	625	—	—	3	84	7	41
Hay	206	169	1	—	8	18	6	4
	1,605	1,342	1	—	14	156	27	65
CARDIGAN.								
Aberayron	217	188	—	—	—	23	1	5
Aberystwyth	470	399	—	—	3	49	10	9
Cardigan	304	265	—	—	2	31	1	5
Lampeter	223	202	—	—	—	18	1	2
Tregaron	178	163	—	—	—	12	1	2
	1,392	1,217	—	—	5	133	14	23
CARMARTHEN.								
Carmarthen	812	724	—	—	—	81	1	6
Llandilo Fawr	778	699	—	—	1	76	—	2
Llandovery	203	174	—	—	—	22	1	6
Llanelly	1,885	1,593	—	—	—	216	56	20
Newcastle-in-Emlyn ..	399	348	—	—	—	34	2	15
	4,077	3,538	—	—	1	429	60	49
CARNARVON.								
Bangor and Beaumaris	904	851	2	—	2	91	3	15
Carnarvon	1,096	975	—	—	—	98	15	7
Conway	824	712	1	—	7	84	3	17
Pwllheli	462	403	—	—	—	38	11	10
	3,345	2,941	3	—	9	311	32	49
DENBIGH.								
Llanrwst	307	258	—	—	—	31	5	13
Ruthin	207	179	—	—	—	22	4	2
Wrexham	2,503	2,200	7	—	10	239	26	21
	3,017	2,637	7	—	10	292	35	36

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed (3.)	Unvaccinated. (Cols. 2 & 3.)		
					ANGLESEY.
86·4	—	0·9	0·9	297	Anglesey.
87·1	—	3·7	3·7	453	Holyhead.
86·8	—	2·6	2·6	750	
					BRECKNOCK.
89·1	0·2	1·2	1·4	365	Brecknock.
79·7	0·9	12·8	13·7	183	Builth.
83·2	0·4	6·3	6·7	550	Crickhowell.
82·0	3·9	4·9	8·8	165	Hay.
83·6	0·9	5·7	6·6	1,263	
					CARDIGAN.
86·6	—	2·8	2·8	207	Aberayron.
84·9	0·6	4·0	4·6	411	Aberystwyth.
87·2	0·7	2·0	2·7	237	Cardigan.
90·6	—	1·3	1·3	113	Lampeter.
91·6	—	1·7	1·7	128	Tregaron.
87·4	0·4	2·7	3·1	1,096	
					CARMARTHEN.
89·2	—	0·9	0·9	692	Carmarthen.
89·8	0·1	0·3	0·4	623	Llandilo Fawr.
86·7	—	3·4	3·4	174	Llandovery.
84·5	—	4·0	4·0	1,890	Llanelly.
87·2	—	4·3	4·3	356	Newcastle-in-Emlyn.
86·6	0·0	2·7	2·7	3,735	
					CARNARVON.
88·3	0·2	1·9	2·1	854	Bangor and Beaumaris.
89·0	—	2·0	2·0	955	Carnarvon.
86·4	0·8	2·4	3·2	709	Conway.
87·2	—	4·5	4·5	340	Pwllheli.
87·9	0·3	2·4	2·7	2,858	
					DENBIGH.
84·0	—	5·9	5·9	259	Llanrwst.
88·5	—	2·9	2·9	211	Ruthin.
87·9	0·4	1·9	2·3	2,190	Wrexham.
87·4	0·3	2·4	2·7	2,660	

in the table, which strictly refer to the births registered in 1903.

—	Births.	Successfully vaccinated.	Insusceptible of vaccination.	Had Small-pox.	Number in respect of whom Certificates of Conscientious Objection have been received.	Died unvaccinated.	Vaccination postponed.	Remaining.
FLINT.								
Asaph, St.	676	584	2	—	1	63	10	16
Hawarden	743	645	—	—	1	51	21	25
Holywell	1,085	957	1	—	—	89	14	24
	2,504	2,186	3	—	2	203	45	65
GLAMORGAN.								
Bridgend and Cowbridge	2,588	2,120	2	—	6	287	78	95
Cardiff	7,267	5,850	28	—	54	672	37	626
Gower	346	310	—	—	1	26	—	9
Merthyr Tydfil	5,322	4,538	9	—	34	554	64	123
Neath	2,725	2,351	—	—	8	256	42	68
Pontardawe	1,071	922	1	—	1	117	10	20
Pontypridd	8,806	6,976	9	—	26	1,061	164	570
Swansea	3,852	3,144	4	—	8	427	7	262
	31,977	26,211	53	—	138	3,400	402	1,773
MERIONETH.								
Bala	117	84	—	—	1	13	9	10
Corwen	410	366	—	—	—	29	6	9
Dolgelly	289	243	—	—	1	35	5	5
Festiniog	776	675	—	—	—	73	10	18
	1,592	1,368	—	—	2	150	30	42
MONTGOMERY.								
Forden	366	327	1	—	—	26	7	5
Llanfyllin	424	381	—	—	4	33	5	1
Machynlleth	251	228	—	—	—	15	1	7
Newtown and Llanidloes	497	358	—	—	2	39	5	93
	1,538	1,294	1	—	6	113	18	106
PEMBROKE.								
Haverfordwest	913	787	—	—	1	77	17	31
Narberth	422	390	—	—	1	28	1	2
Pembroke	841	700	4	—	3	79	42	13
	2,176	1,877	4	—	5	184	60	46
RADNOR.								
Knighton	279	214	1	—	9	15	5	35
Rhayader	239	99	—	—	1	19	—	120
	518	313	1	—	10	34	5	155

* The figures in this column have no reference to the other columns

1903—*continued.*

PERCENTAGES of BIRTHS registered in 1903.				Total Number of Certificates of Successful Primary Vaccination at ALL AGES received during the calendar year 1904.	—
Successfully vaccinated. (1.)	Exempted by "Conscientious Objection" Certificates. (2.)	Not finally accounted for, including cases postponed. (3.)	Unvaccinated. (Cols. 2 & 3.)		
					FLINT.
86·4	0·1	3·8	3·9	629	Asaph, St.
86·8	0·1	6·2	6·3	630	Hawarden.
88·2	—	3·5	3·5	997	Holywell.
87·3	0·1	4·4	4·5	2,256	
					GLAMORGAN.
81·9	0·2	6·7	6·9	2,370	Bridgend and Cowbridge.
86·5	0·7	9·1	9·8	5,781	Cardiff.
89·6	0·3	2·6	2·9	281	Gower.
85·3	0·6	3·5	4·1	4,502	Merthyr Tydfil.
86·3	0·3	4·0	4·3	2,505	Neath.
86·1	0·1	2·8	2·9	932	Pontardawe.
79·2	0·3	8·3	8·6	7,471	Pontypridd.
81·6	0·2	7·0	7·2	3,315	Swansea.
82·0	0·4	6·8	7·2	27,157	
					MERIONETH.
71·8	0·9	16·2	17·1	88	Bala.
89·3	—	3·7	3·7	430	Corwen.
84·1	0·3	3·5	3·8	265	Dolgelly.
87·0	—	3·6	3·6	668	Festiniog.
85·9	0·1	4·5	4·6	1,451	
					MONTGOMERY.
89·3	—	3·3	3·3	347	Forden.
89·9	0·9	1·4	2·3	381	Llanfyllin.
90·8	—	3·2	3·2	191	Machynlleth.
72·9	0·4	19·7	20·1	394	Newtown and Llanidloes.
84·1	0·4	8·1	8·5	1,313	
					PEMBROKE.
86·3	0·1	5·3	5·4	731	Haverfordwest.
92·4	0·2	0·7	0·9	357	Narberth.
83·2	0·4	6·5	6·9	744	Pembroke.
86·3	0·2	4·9	5·1	1,832	
					RADNOR.
76·7	3·2	14·3	17·5	164	Knighton.
41·4	0·4	50·2	50·6	177	Rhayader.
60·4	1·9	30·9	32·8	341	

in the table, which strictly refer to the births registered in 1903.

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No. 17.

SUMMARY of the PROGRESS and DIFFUSION of PLAGUE throughout the WORLD during 1904: by Dr. R. BRUCE LOW.

INDIA.

Plague continued its ravages upon the people of India during 1904, the number of recorded cases and deaths having exceeded anything as yet experienced in that country, as will be seen by reference to the table below, which gives the number of reported plague attacks and deaths in each of the 9 years 1896 to 1904.

Plague.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Attacks ..	2,980	73,855	151,64[illegible]	178,155	116,017	382,750	705,172	1,127,205	1,319,320
Deaths ..	2,288	56,548	117,733	135,906	92,106	283,778	575,489	805,747	1,112,576
Case mortality per cent.	76·7	75·4	77·6	77·3	83·7	78·2	75·2	78·7	84·3

The total reported cases during the last 9 years has amounted to 4,088,894, and the deaths have attained an aggregate of 3,241,041, the case mortality for the period being 79·3.

As regards the incidence of the disease upon the different Provinces and States, it may be stated briefly that the Punjaub and the Presidency of Bombay suffered most severely, the United Provinces of Agra and Oudh coming next.

In the next table are given the number of recorded plague attacks and deaths, the case mortality, and the rates of incidence per 1000 of the population in each of the Provinces and States of India.

TABLE showing the number of recorded plague attacks and deaths, the case mortality, and the rates of incidence per 1,000 of the population in the Provinces and States of India during 1904.

Presidency, Province, or State.	Population, census of 1901.	Plague.		Case mortality per cent.	Plague attack rate per 1,000 of the population.	Plague death rate per 1,000 of the population.
		Attacks.	Deaths.			
Presidency of Bombay (including Native States).	25,468,209	371,291	287,304	77·4	14·6	11·3
Presidency of Madras (including Native States).	42,397,522	26,990	20,129	74·6	0·6	0·5
Presidency of Bengal (including Native States).	78,493,410	76,010*	75,436	99·2*	1·0	1·0

TABLE showing the number of recorded plague attacks and deaths, the case mortality, and the rates of incidence per 1,000 of the population in the Provinces and States of India during 1904—*continued*.

Presidency, Province, or State.	Population, census of 1901.	Plague.		Case mortality per cent.	Plague attack rate per 1,000 of the population.	Plague death rate per 1,000 of the population.
		Attacks.	Deaths.			
United Provinces of Agra and Oudh (including Native States).	48,493,879	179,585*	179,082	99·7*	3·7	3·7
Punjaub (including Native States).	24,754,737	481,412	402,950	83·7	19·4	16·3
Central Provinces (including Berar and Native States).	14,627,045	49,001	42,967	87·7	3·4	2·9
Mysore State	5,539,399	32,949	24,196	73·4	5·9	4·4
Hyderabad State	11,141,142	31,374	25,596	81·6	2·9	2·3
Central India	8,628,781	38,105	26,545	69·7	4·4	3·1
Rajputana (including Ajmer Merwara).	9,723,301	21,115	19,426	92·0	2·2	2·0
Kashmir (including the Jammu State).	2,905,578	11,400	8,691	76·2	3·9	3·0
North West Frontier ..	2,125,480	6	1	—	—	—
Baluchistan (including administered territory and Agency Tracts).	810,746	27	25	—	—	—
Burma	10,490,624	3	3	—	—	—
Coorg	180,607	52	25	—	—	—
Assam	6,128,343	—	—	—	—	—
States, Islands, &c., not included above.	2,454,253	—	—	—	—	—
Totals	294,361,056	1,319,320	1,112,376	84·3	4·5	3·8

* The number of attacks is obtained by adding together the figures given in the weekly plague statement transmitted by the Government of India to this country. The official annual reports do not give the revised figures as to plague attacks in the Bengal Presidency and the United Provinces. Obviously the number of attacks given understates the true incidence of the disease, and hence the case mortality rates given above are not to be regarded as representing the actual fatality rates in these two provinces.

BOMBAY PRESIDENCY.

(Population, census 1901, 25,468,209.)

For the last 9 years plague has been epidemic in this Presidency, but there was a slight reduction in the amount of the disease in 1904 as compared with 1903.

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In the table below is shown the number of attacks and deaths from plague and the case mortality in Bombay Presidency, including the Native States, for each of the 9 years 1896 to 1904 inclusive :—

Year.	Plague.		Case mortality per cent.
	Attacks.	Deaths.	
1896	2,980	2,288	76·7
1897	73,052	55,168	75·5
1898	135,572	105,311	77·6
1899	152,482	116,992	76·7
1900	49,131	38,268	77·8
1901	207,387	157,552	75·9
1902	293,378	217,957	73·9
1903	464,313	363,752	78·3
1904	371,291	287,304	77·4
Total in 9 years ...	1,749,586	1,344,592	76·9

The distribution of the cases and deaths throughout the year is given in the subjoined tabular statement, which shows that the disease greatly diminished during the months of May, June, and July :—

Plague in Bombay Presidency, including the Native States.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Attacks	37,257	40,537	47,062	30,236	9,324	3,405	8,400	26,220	42,467	55,775	42,934	27,674	371,291
Deaths	29,497	30,750	36,249	22,907	7,121	2,754	7,055	20,320	33,611	44,486	31,358	21,198	287,304

The Collectorates which showed the highest incidence of plague in 1904 were Bijapur Kaira, Satara, Belgaum, and Dharwar.

City of Bombay (census population in 1901, 776,006).—In 1904 less plague was reported in Bombay City than in 1903, only 15,488 attacks being notified, with 13,538 deaths, as compared with 23,344 cases and 20,788 deaths in 1903. The distribution of the disease throughout the year is shown in the table below :—

Plague in Bombay City.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Attacks	1,111	2,783	4,655	3,578	1,118	297	235	254	323	337	330	462	15,488
Deaths	954	2,472	4,098	3,086	1,008	258	203	220	279	287	276	397	13,538

The case mortality calculated on the above totals was 87·4 per cent.

The ravages of plague in Bombay City during the 9 years 1896 to 1904 inclusive, as shown in the annual returns, are set out in the subjoined tables :—

Year.	Reported Plague.		Case mortality per cent.
	Attacks.	Deaths.	
1896	2,544	1,936	76·1
1897	13,314	11,003	82·6
1898	19,863	18,130	91·2
1899	19,454	15,874	81·6
1900	17,915	13,247	73·9
1901	20,885	18,694	89·5
1902	16,423	14,088	85·7
1903	23,344	20,788	89·1
1904	15,488	13,538	87·4
In 9 years	149,230	127,298	85·3

Considerable attention was given by the municipal authorities during 1904 to the destruction of rats, various methods being employed. Among others the use of Danysz virus was again given further trial, but with little success. Such poison as "Rough on Rats," phosphorus pills coated with wheat flour, were commonly used. Extended experimental trials were made of "Commonsense rat exterminator," a Canadian patent preparation, but the results were not regarded as a success.

Dr. Turner, in his annual report for 1904,* in dealing with plague-preventive measures, says "the only real palliative with regard to the spread of plague is to place the people under better surroundings during the epidemic periods and to supervise them while living in them, to investigate every plague case which occurs, and to take what measures are allowed to prevent the sick and the healthy mixing together, to disinfect the houses and clothes, to provide medical aid, to remove as quickly as possible all filth, and to try and teach the people the value of attention to cleanliness and healthier surroundings." Working on these lines, Dr. Turner has urged on his municipality the provision of more temporary huts to facilitate the evacuation of plague-infected or insanitary houses.

* Annual Report of the Executive Health Officer of the Municipality, Bombay, for 1904, page 38.

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PLAGUE ADMINISTRATION; THE PORT OF BOMBAY.

During 1904 the number of vessels entering or leaving the port was 92,731, and of these 15,154 were inspected. The number of persons inspected (including the crews) on these vessels was 751,039, and the number of plague cases which came under observation among these persons was 58.

In January and February, 7 cases of plague occurred on board the *ss. India* while lying at anchor in Bombay Harbour. This vessel arrived from Calcutta on December 9th, 1903. The master remained on board up to January 20th, 1904, during which time there were no cases of sickness on board, nor had any dead rats been found on the ship. The first persons were attacked on January 25th and 27th respectively, and were taken on shore to the hospital. The other cases developed between the latter date and February 2nd. It was not till February 1st that three dead rats were found on the ship, and on the next day two more. Upon this the ship's holds were at once fumigated by means of Clayton's apparatus, and the other parts of the ship were also properly disinfected.

It is stated that on vessels (steamers, square-rigged vessels, and native craft) which became infected by plague while lying in the Port of Bombay, there were reported 20 cases and 19 deaths from the disease.

During the year, 16,682 pilgrims left Bombay by sea for Jeddah to undertake the Haj; and during the same period 14,794 pilgrims returning from Mecca entered the port. The appended table shows, for the last 8 years, the number of vessels examined at the port of Bombay, the total number of persons on board inspected, and the number of plague cases discovered.

Year.	Number of Vessels Examined.	Number of Crew and Passengers Inspected.	Number of Plague Cases Discovered.
1897	72,808	1,313,117	169
1898	71,498	1,207,571	236
1899	65,822	1,193,339	155
1900	65,966	1,173,050	84
1901	34,637*	886,310*	73
1902	15,432	701,964	44
1903	14,597	719,322	77
1904	15,154	751,039	58

* Lieut.-Colonel Crimmin, V.C., I.M.S., Port Medical Officer of Health, accounts for the decrease in the number of vessels and persons inspected by the fact that vessels sailing from the port of Bombay for ports on the coast of the Kolaba district as far south as Boha, were exempt from medical inspection in accordance with the Government Notifications of April 17th and September 30th, 1901.

BENGAL.

(Population, Census of 1901, 74,428,193.)

There was a marked increase in the amount of plague in this Presidency during 1904, there having been nearly 10,000 more deaths from this cause than in the previous year. In 1904, there were 76,010* cases and 75,436 deaths as compared with 74,265 attacks and 65,680 deaths during 1903.

It is stated† that during the last 3 years the mortality from plague in Bengal has been considerably higher among females than among males. In the year now under consideration there were 43,258 plague deaths in females as compared with 32,178 in males, the rates per 1,000 of the population being for the sexes 1·16 and 0·86 respectively.

The explanation officially given by the Sanitary Commissioner is that plague, being a house disease, it is largely by the medium of the house that human beings are infected; women and children, consequently, are the chief sufferers.

The subjoined table gives the number of certified deaths from plague month by month during 1904.

Plague in the Bengal Presidency.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Deaths..	8,385	14,174	23,472	10,791	1,938	667	518	1,810	1,667	1,021	2,200	8,793	75,436

The chief districts affected were Patna (26,010 deaths), Saran (17,392), and Shahabad (10,484). Several towns suffered severely, such as Haipur, which in 1904 had a mortality from plague of 52·26 per 1,000, Tikari 49·0 per 1·000, Siwan 47·91, and Monghyr 34·33.

The chief measures employed in Bengal to combat the disease were disinfection and evacuation of infected houses. Segregation and inoculation were not much used as they are not looked upon with favour by the population.

CALCUTTA CITY.

(Population, Census 1901, 847,796.)

There was a marked decrease in the amount of plague recorded during 1904 in the City of Calcutta as compared with 1903. The reported attacks in 1904 numbered 4,995 and the deaths 4,689, against 8,891 cases and 8,223 deaths in 1903. The subjoined table

* This number represents the total cases given in the weekly plague statements transmitted to this country by the Government of India, but obviously it does not represent the full incidence of the attacks.

† Annual Report of the Sanitary Commissioner for Bengal, year 1904, by Captain W. Wesley Clemesha, M.D., I.M.S., Officiating Sanitary Commissioner for Bengal, Calcutta, 1905.

gives the number of cases and deaths from plague in Calcutta from 1898 to 1904 inclusive :—

Plague in Calcutta.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Attacks	238	3,005	8,822	8,611	7,789	8,891	4,995
Deaths	203	2,745	8,278	7.883	7,284	8,223	4,689
Case mortality per cent.	85·3	91·3	93·8	91·5	93·5	92·4	94·2

It will be seen that though there was a reduction in the number of plague cases and deaths in Calcutta during 1904 the case mortality was higher than in any of the previous 6 years. As compared with the rest of India, the case mortality from plague in Calcutta has been persistently high, raising a presumption that all attacks are not made known, and that concealment of cases takes place.

The distribution of the plague attacks and deaths month by month in Calcutta during 1904 is shown in tabular form below :—

Plague in Calcutta.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904
Attacks ..	65	348	1,696	1,985	569	137	39	27	8	11	40	70	4,995
Deaths ..	65	323	1,514	1,910	563	131	38	25	8	10	34	68	4,689

Madras Presidency.

(Population in 1901, 42,397,522.)

During 1904 the total notified cases of plague in the Presidency was 26,990 and the deaths numbered 20,125, a case mortality of 74·5 per cent. It will be seen from the table below that there has been a gradual increase of plague in the Madras Presidency during the last 5 years :—

Year.	Plague Attacks.	Plague Deaths.	Case Mortality per cent.
1900	915	685	74·8
1901	3,686	3,035	76·4
1902	15,425	12,603	81·0
1903	16,853	13,291	78·8
1904	26,990	20,129	74·5

This Presidency has in a great measure escaped the ravages of plague during recent years as compared with other great Provinces and States of India. Whether this is due to the measures adopted in the Presidency as compared with those carried out in the other provinces it is not possible to say, but Colonel W. G. King, I.M.S., the Sanitary Commissioner with the Government of Madras, lays some stress upon the system in vogue of surveillance of all persons coming from infected areas within or without the Presidency. This surveillance is carried out by means of the passport system, without respect to rank or race.* A strong opinion is expressed by the Sanitary Commissioner that "the plague introducing agent is man, as a rule," and that "the rat is an agent of spread of the disease acquired from man, and thereafter becomes a very serious factor in disseminating the disease and complicating the difficulty in dealing with it; but that the area within which rats become infected is small."

Rat poison was used with some effect (two of the commonly advertised kinds being employed). Also trials of the Danysz virus were made in the City of Madras, a considerable quantity having been obtained from Europe; but the results were not satisfactory. Laboratory experiments with the virus at the King Institute by Lieut. Christophers, I.M.S., showed that the action of the virus was in no way superior to that of an ordinary rat poison.

During 1904 comparatively little inoculation with Haffkine's prophylactic was done, only 1,562 persons submitting to the operation and of these 5 afterwards died of plague.

The City of Madras, as in former years, escaped the ravages of epidemic plague, only 22 cases with 11 deaths being reported during the twelve months in a population of about half a million.

The districts in the Presidency which chiefly suffered from plague during the year were Bellary, Coimbatore, Anantapur, North Arcot, and Salem.

The subjoined table shows month by month during 1904 the number of reported cases of plague and deaths therefrom in the Presidency of Madras:—

Plague in the Madras Presidency.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Attacks ..	4,333	4,396	2,393	805	270	455	1,567	2,500	2,570	3,021	2,191	2,489	26,990
Deaths ..	3,763	3,416	1,660	432	214	461	1,037	2,076	2,141	1,765	1,631	1,533	20,129

* Annual Report, for 1904, of the Sanitary Commissioner with the Government of Madras.

THE UNITED PROVINCES OF AGRA AND OUDH.

(Population Census 1901, 47,691,782.

Plague showed a considerable increase in the United Provinces during 1904, the number of reported deaths being 179,082 against 84,499 deaths in 1903. The following table shows month by month for 1904 the incidence of plague in the United Provinces:—

Plague in the United Provinces.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Deaths.. ..	18,710	26,092	13,354	25,506	5,606	606	361	1,945	3,468	6,178	12,522	34,733	179,082

The death-rate per 1,000 of the population was 3·75 as compared with 1·77 in 1903. The highest district rates were in Ballia 17·63 and Ghazipur 14·31; while, in the towns, Mubarakpur (population 15,438) had a rate of 113·20 and Mau (population 17,696) a rate of 101·21 per 1,000. During 1904, 3,258 persons were inoculated with Haffkine's prophylactic; only two of them are known to have died of plague.

THE PUNJAUB.

(Population, Census 1901, including Native States, 24,754,737.)

During 1904 plague was epidemic over a wide area in this province, 435,105 cases with 364,740 deaths being reported in the British districts, while in the Native States 46,307 cases and 38,210 deaths were certified. For the whole province the attacks were 481,412 of which 402,950 proved fatal, a case mortality of 83·7 per cent. This is by far the highest incidence of plague as yet experienced in the Punjaub. The districts showing the greatest amount of the disease during the year were Jullundur, Gurdaspur, Shapur, Ludhiana, and Gujrat. The Native States which suffered most were Patiala, Kapurthala, and Malerkotla.

The height of the Punjaub epidemic was reached in April and May, in which months the notified cases amounted to 160,684 and 117,853 respectively.

It is admitted that the plague statistics of this province are as regards some districts at least, defective.

The appended table gives the reported plague attacks and deaths in each district of the Punjaub during 1904 :—

THE PUNJAUB.

TABLE showing incidence of Plague on the British Districts of the Punjaub during 1904.

—	Population, Census of 1901.	Plague.		Plague, attack rate per 1,000 of the population.	Plague death rate per 1,000 of the population.	Case mortality per cent.
		Attacks.	Deaths.			
British Districts.						
Hissar	781,717	3,580	3,030	4·58	3·88	84·6
Rohtak	630,672	5,189	4,496	8·23	7·13	86·6
Gurgaon	748,208	7,902	7,170	10·59	9·61	90·7
Delhi	696,998	1,314	966	1·91	1·41	73·5
Karnal	883,225	3,351	2,335	3·79	2·64	69·7
Ambala	763,250	23,555	20,262	30·86	26·55	86·0
Simla	35,579	7	3	0·20	0·08	42·9
Kangra	764,441	25	15	0·03	0·02	60·0
Hoshiapur	989,782	31,319	28,340	31·64	28·63	90·5
Jullundur	904,307	48,022	32,008	53·10	35·40	66·7
Ludhiana	673,097	41,940	33,957	62·31	50·45	81·0
Ferozepore	932,206	14,865	10,116	15·95	10·85	68·1
Sialkot	1,071,327	29,836	23,453	27·85	21·89	78·6
Gujranwala	890,577	28,058	27,593	31·51	30·98	98·3
Montgomery	497,706	1,070	403	2·15	0·81	37·7
Lahore	1,146,029	26,233	25,734	22·89	22·45	98·1
Amritsar	1,023,438	24,680	22,438	24·14	21·95	90·9
Gurdaspur	936,784	46,050	39,933	49·16	42·63	86·7
Gujrat	750,548	33,232	29,830	44·28	39·74	89·8
Shapur	524,259	45,510	37,278	86·81	71·11	81·9
Jhelum	498,176	13,509	11,066	27·12	22·21	81·9
Rawalpindi	517,761	1,051	774	2·03	1·49	73·6
Attock	460,897	27	23	0·06	0·05	85·2
Mianwali	424,588	4	3	0·01	0·01	75·0
Multan	697,859	141	112	0·20	0·16	79·4
Jhang	1,002,656	4,559	3,349	4·55	3·34	73·5
Dera Ghazi Khan	469,947	76	53	0·16	0·11	69·7
Muzaffargarh	405,656	—	—	—	—	—

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TABLE showing incidence of Plague on the Native States of the Punjaub during 1904.

—	Population, Census of 1901.	Plague.		Plague attack rate per 1,000 of the population.	Plague death rate per 1,000 of the population.	Case mortality per cent.
		Attacks.	Deaths.			
Native States.						
Patiala	1,596,892	23,522	21,098	14·73	13·21	89·7
Kapurthala	314,351	9,713	6,691	30·90	21·29	68·9
Malerkotla	77,506	5,004	4,246	64·56	54·78	84·9
Thind	282,003	2,720	2,038	9·65	7·23	74·9
Kalsia	67,181	2,084	1,476	31·02	21·97	70·8
Faridkot	124,912	312	133	2·50	1·06	42·6
Nabha	297,949	2,921	2,503	9·80	8·40	85·7
Dujana	24,174	31	25	1·28	1·03	80·6
Other Native States and Cantonments.	1,861,279	—	—	—	—	—
Total for British Districts and Native States.	24,754,737	481,412	402,950	19·45	16·28	83·7

Some amount of preventive inoculation with Haffkine's prophylactic was carried out, 49,107 inoculations having been performed in the British districts and 6,277 in the Native States, a total of 55,384 for the year. Of these persons 2,366 were attacked by plague and 1,671 died. It is, however, asserted that these figures, like the other plague statistics in the Punjaub, are imperfect, and that conclusions drawn from them are not to be depended upon. Attempts are being made to place the returns of plague sickness and death upon a more correct basis, but difficulty is met with in getting precise data from native reporters or officials.

In the Annual Report of the Sanitary Commissioner of the Punjaub for 1904,* it is stated that in a very large proportion of infected towns and villages rats were found dying or dead before the occurrence of human infection, and that in addition to rats, such animals as cats, dogs, squirrels, and monkeys also suffered from plague during the prevalence of the disease. Infection is generally stated to have been conveyed by human agency or by clothing, as well as by means of rats. Most of the plague medical officers said that the disease raged with greatest virulence in filthy villages and amongst filthy people.

* Report on the Sanitary Administration of the Punjaub for the year 1904, by Lieut.-Colonel C. J. Bamber, I.M.S., Sanitary Commissioner; Lahore, 1905.

The table below shows the progress and spread of plague in the Punjaub from 1897 to 1904 :—

Plague.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Attacks	302	3,135	408	883	31,507	308,417	341,511	481,412
Deaths	175	2,019	255	591	18,877	221,766	210,617	402,9·0
Case mortality, per cent.	57·9	64·4	62·5	66·9	59·9	71·9	61·7	83·7

In 1904 the deaths from plague in the Punjaub constituted no less than two-fifths of the total mortality from all causes.

CENTRAL PROVINCES.

(Population 1901, 14,627,045.)

The amount of plague in the Central Provinces including the Native States during 1904 was much the same as in the previous year, rather more attacks but fewer deaths being notified; the number of cases and deaths in 1904 being respectively 49,001 and 42,967, as against 47,526 cases and 44,616 deaths in 1903.

The progress year by year of plague in the Central Provinces, as shown by the deaths registered from this cause, has been as follows :—

Central Provinces.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Deaths from plague	11	131	584	607	9	188	44,616	42,967

The distribution of the plague attacks and deaths month by month during 1904 is shown below in tabular form, the chief incidence of the disease being during the first four months of the year :—

Plague in the Central Provinces.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December	Total in 1904.
Attacks ..	10,299	10,071	11,239	5,333	263	8	55	661	1,937	3,473	2,386	2,076	49,001
Deaths ..	9,051	9,623	10,843	4,529	380	18	26	430	1,631	2,388	2,045	1,963	42,967

The case mortality was 87·4 per cent.

BURMA.

Only three plague attacks were reported in Burma during 1904, all of them fatal and all of them ship-borne cases connected with the port of Rangoon, viz. :—

(1) A passenger who arrived on February 18th on board the ss. *Bihara* from Calcutta. He was found ill on board at the medical inspection, and was removed to the observation camp on shore, where he died two days later, the diagnosis of plague having been bacteriologically confirmed.

(2) A native fireman on board the ss. *Bangula*, which arrived from Calcutta on April 27th. The man became ill on the voyage and died just before reaching port.

(3) A Goanese, one of the crew of the ss. *Twingone*, was found in a moribund condition on arrival of this ship on December 9th, and died during medical inspection of the vessel. Owing to rapid putrefaction of material from this man's body the bacterioscopic examination was unsatisfactory.

A fourth ship, the ss. *Haddon Hall*, had a death on board from suspected plague, the person being buried at sea on November 3rd, during the voyage from Bombay to Rangoon.

CENTRAL INDIA.

(Population 8,628,781.)

During 1904, in Central India, 38,105 plague attacks were notified and 26,545 deaths, as compared with 33,162 cases and 21,169 deaths in 1903. The distribution of the plague deaths, month by month, throughout 1904 in Central India is shown in the table below.

Plague.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Deaths	3,685	3,247	4,609	2,249	987	76	48	1,258	4,579	3,790	1,140	877	26,545

RAJPUTANA.

(Population 9,723,301.)

In Rajputana, including Ajmer Merwara, there were reported 21,115 cases and 19,426 deaths from plague during 1904. The largest number of cases and deaths occurred in the months of March and April, though the disease persisted throughout the whole year, the month of June yielding the smallest number of attacks.

MYSORE.

(Population 5,539,399.)

Plague continued to be epidemic in the state of Mysore during 1904, the reported attacks numbering some 32,949 and the deaths 24,196, as compared with 29,405 cases with 22,291 deaths in 1903. Of the 24,196 deaths in 1904, 2,574 were referred to the Bangalore Civil and Military station.

HYDERABAD.

In the state of Hyderabad 31,374 plague attacks were reported in 1904, 25,596 proving fatal; the greatest number of cases and deaths being notified during the first three months of the year.

KASHMIR.

(Population 2,905,578.)

During the year under review 11,400 plague attacks were reported in Kashmir, including the Jammu State, and of these 8,691 proved fatal, the largest number of cases and deaths being certified during the months of March and April.

As regards the rest of India, it may be mentioned that 52 plague cases and 25 deaths were reported from Coorg; 27 cases and 25 deaths from Baluchistan; six cases and one death from the North West Frontier.

It may be mentioned that Assam, with a population of over six millions, remained quite free from plague during 1904.

PERSIA.

In the seaport town of Linga (or Linjah), situated on the shores of the Persian Gulf and in the province of Laristan, plague broke out in April, and up to the beginning of June had caused 125 deaths. Linga lies on the mainland not far west from the island of Kishm in the straits of Ormuz. It is a centre of the pearl fishing industry, and many Indian merchants and their representatives go there in connection with this business. In all probability the infection was brought by these persons to Linga. The outbreak caused considerable panic, and a number of the inhabitants fled from the town to the mountains to escape the infection. The information obtainable as to the epidemic is somewhat scanty.

SIAM.

Bangkok.—In December plague appeared at Bangkok, the capital of Siam, among some Indian traders who were living on the western bank of the Menam, on which river the city lies. It

is said that this was the first appearance of plague in Bangkok since 1782. The population of the city is estimated at over 500,000, of which 220,000 are Chinese. But contrary to expectation, plague did not on this occasion spread, for up to January 3rd, 1905, only 11 deaths from the disease had been certified.

Puket or *Tonka*, on the western coast of the Malay Peninsula, in Siamese territory, was invaded by plague in April, 18 cases being notified, of which 12 proved fatal. But no information as to the source of the disease has been forthcoming.

STRAITS SETTLEMENTS.

Singapore.—Early in September several cases of plague, all fatal, were reported in Singapore, but their source was not traced. At the beginning of October a single isolated case came under observation. In November some scattered cases were notified, 2 of them having occurred among native passengers on board the coasting steamer *Kistna* while in the harbour. In the month of December 6 cases were reported, making a total of 20 cases of plague, all fatal, in Singapore during 1904. In the first half of January, 1905, 4 more cases came under notice, but there was no epidemic.

No other plague cases came under observation in any part of the Straits Settlements during 1904.

THE PHILIPPINE ISLANDS.

There was comparatively little plague in the Philippines during 1904; only 65 cases, 55 of them fatal, were reported in Manila; in addition some 6 fatal cases occurred in Cebu; and a single case at Calbayog in the island of Samar.

The Manila cases were distributed throughout the year as follows:—

Plague in Manila.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Attacks	10	4	13	12	16	1	1	3	1	—	—	4	65
Deaths	7	3	11	10	15	—	1	3	1	—	—	4	55

CHINA.

Hong Kong.—Plague was less prevalent in Hong Kong during 1904 than in the previous year, only 510 reported cases and 495 deaths (a case mortality of 97 per cent.) having come under observation, as compared with 1,415 cases and 985 deaths in 1903. Of the total 510 cases 507 were Chinese and 3 Indians, and of the

deaths 492 were Chinese and 3 Indians. The attacks and deaths were distributed throughout the year as shown in the subjoined table :—

1904.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Reported plague attacks	—	3	4	40	135	194	96	18	10	—	5	5	510
" " deaths	—	3	2	39	118	175	121	17	10	—	5	5	495

The plague prevalence in Hong Kong began in February and reached its height in June, following much the same course as in previous years. Of the total cases, 123 were discovered after death, making a proportion of 24·8 per cent. of the plague deaths. As compared with the two previous years this is an improvement, as may be seen in the following table :—

Hong Kong.	1898.	1899	1900.	1901.	1902.	1903.	1904.
Percentage of plague corpses found in the streets to total plague deaths.	23·1	24·2	29·5	19·7	34·6	31·7	24·8

In a recent report* by Dr. W. W. Pearse, the Acting Medical Officer of Health for the Colony, the modes of transmission of this disease are discussed The usual channels of infection are given as three, viz. :—(1) Through the skin; (2) through the alimentary canal; and (3) through the respiratory tract. Dr. Pearse, while giving support to the first named as the usual channel of infection at Hong Kong (except in primary pneumonic plague, where the third is the usual channel), takes the opportunity of stating his dissent from the views and conclusions of Professor Simpson as set forth in his official report,† which views are supported by Dr. Hunter, the Hong Kong bacteriologist. Professor Simpson attaches considerable importance to the spread of plague by means of food, and to the prevalence of plague among certain domestic animals not usually believed to suffer from the disease.

This matter has also been investigated in India by Colonel Bannerman, I.M.S., since Professor Simpson's report was published, experiments being undertaken to ascertain whether the common domestic animals of India are affected by plague. The result has been to throw some doubt on the conclusions arrived at by Professor Simpson. This difference of opinion has been regarded as of such importance that the Secretary of State for India has requested the Joint Committee of the Lister Institute

* Report of the Acting Medical Officer of Health on the epidemic of plague in the Colony of Hong Kong during the year 1904.

† Report on the causes and continuance of plague in Hong Kong, by Professor W. J. Simpson, M.D., F.R.C.P.

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and the Royal Society, which is supervising the recent Plague Research Expedition to India, to cause the question at issue to be re-investigated in India by the Expedition.

It is not unlikely that plague infection may be, under certain conditions, conveyed to man by means of articles of food; but whether this occurs under the ordinary conditions of life in India or China remains to be proved. It may be anticipated that the above-mentioned re-investigation of the subject by experts will set the matter at rest.

Canton, *Fatshan*, *Foochow*, *Honam*, and *Amoy* were all visited by plague during 1904, but as in former years definite details of these outbreaks are not forthcoming.

In Swatow and district plague prevailed from April to August; the disease was specially rife in Chao-Yang, which lies 9 or 10 miles from Swatow. It is said that for some time during the epidemic at least 80 persons daily died here from the disease. Other places invaded in the vicinity of Chao-Yang were Tathanpan, Haimen, Cinpo, Fi-Kia, and Tung Ki-on.

Kwang-Tcheou-Wan.—In this territory, which is situated on the peninsula of Lei-Tcheou, directly north of the Island of Hainan, and which is at present leased by China to France and attached to the Tonkin Administration, plague broke out in April and did not subside till September. No fewer than 4,677 deaths were ascribed to plague during that period. No Europeans were attacked.

JAPAN.

There was no epidemic of plague in Japan proper, and, with the exception of Formosa, plague in these islands was limited to imported cases on board ships.

Kobé (population 200,000).—A single fatal case of pneumonic plague in the person of a Chinese steerage passenger was discovered at Kobé, on board the s.s. *Korea* from Hong Kong and Shanghai, on May 31st, 1904. The diagnosis was confirmed bacterioscopically. The usual precautionary measures were carried out, and no extension of the disease took place. None of the reports published refer to the infection of ship rats. Presumably they had not suffered from plague.

Moji.—Three cases of plague were reported on board the s.s. *Sealda* at Moji between October 31st and November 3rd. The vessel had left Rangoon in September, touching at Singapore and Hong Kong on the voyage to Japan. The cargo consisted of rice and cotton, part of which was landed at Yokohama before the vessel went on to Moji. All three cases proved fatal. It was believed that the infection had in some way been received at Hong Kong. No mention is made in any of the reports published as to this outbreak on board the *Sealda* with regard to the occurrence of plague among the rats on the vessel. It is inferred that there was no infection of the rodents on board.

Tokio (population about 1,500,000).—Early in June two plague infected rats were found in Tokio. The local press asserted that the infection of these rats had been derived from a cargo of beans which had been shipped at Niuchwang and which had been carried to Hong Kong before being conveyed to Japan. In some ports in the Far East, Hong Kong is designated "the plague distribution centre of the world," and any plague difficult to account for is readily attributed to that port. Seemingly there was no extension of rat plague in Tokio during 1904.

Formosa (estimated population 2,797,543).—During 1904 there were reported in the Island of Formosa 4,449 plague cases and 3,348 deaths. These were distributed throughout the year as shown in the tabular statement below :—

Plague in Formosa.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Attacks ..	27	115	558	1,535	1,308	433	108	36	4	47	81	197	4,449
Deaths ..	24	80	368	1,036	988	329	182	39	4	43	76	183	3,348

The case mortality was 75·2 per cent.

The chief localities invaded were Kagi, Tainan, Ensoiko, Taihoku, and in a less degree Keelung Shinchiku and Taipeh.

Plague has persisted in Formosa since 1896, but in that and in the two following years the amount was not great. In 1899, however, the disease began to assume more epidemic proportions, and from that year to 1904 plague has continued to prevail in Formosa in varying amount.

The following table shows the number of plague attacks and deaths in Formosa year by year from 1896 to 1904 inclusive :—

Plague in Formosa.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Attacks	187	730	1,233	2,637	1,081	4,519	2,238	889	4,449
Deaths	126	566	882	1,995	807	3,624	1,740	709	3,348
Case mortality per cent.	66·0	77·5	71·6	75·6	73·7	80·4	77·7	79·8	75·2

HAWAIIAN ISLANDS.

There was no plague epidemic in the Hawaiian Islands during 1904, but sporadic cases, 10 in number, eight of them fatal, were reported in Honolulu, disposed throughout the year, viz. :—Two cases, one fatal, in January ; one fatal case in May ; two cases, one fatal, in June ; two in August, both fatal ; one in November ; and two in December.

Two other fatal cases occurred in other places in these islands, viz., one at Hilo in August and one in September at Kohala.

AUSTRALIA.

NEW SOUTH WALES.

Sydney.—Sporadic cases of plague were reported during 1904 in Sydney, amounting altogether to some 12 attacks, six of which proved fatal. The first of these cases was reported on March 10th, there having been no previous recognised case since July, 1903. Early in March, about the 6th or 8th, 1904, one mouse and one rat were discovered to be infected by plague, and during the next few days other infected rodents were found. Prior to this no plague infected rodents had been discovered since August, 1903, though a considerable number of rats and mice, about 600 weekly, had been examined in the Bacteriological Laboratory at Sydney. Under these circumstances the local official opinion was that the infection had been re-introduced from Queensland by means of rats. In April two more human cases were notified, and in May four others. One of these latter persons was a member of the cleansing staff of the municipality. After this two fatal cases occurred in June. No more cases were reported till the beginning of August, when a single fatal case came under observation. At Maryfield, one of the suburbs, in a house situated about six miles from the centre of Sydney, two cases of plague were reported early in September, one of the victims being a coachman and the other a housekeeper in the same service. It was believed that plague infection had been brought to Maryfield from Sydney by means of fodder. It is stated that dead rats had been found in the stable and also in the house where these two persons were employed.

The last infected rat found in Sydney and district during 1904 was on October 11th, and the two suburban cases above referred to were the last of those met with in 1904, though early in 1905 there was a fresh appearance of the disease after a three months' interval of apparent freedom from infection.

QUEENSLAND.

Brisbane (population 125,500).—From October, 1903, to February 9th, 1904, no human plague cases were reported in Brisbane, but on February 9th a case was notified, followed by six others during the same month. No cases were recognised in March, but seven were certified in April and 12 in May. The number of attacks fell to three in June, one in July, followed by four in August and one in September, making a total of 30 cases, eight of which proved fatal.

It is stated that as in former years plague in rats preceded and accompanied the cases of plague in man. In 1903 the last rodent infected by plague was found on September 23th, and from that date to January 8th though many rats and mice were examined none were discovered infected till the last-named date.

From an official report by Dr. Burnett Ham, Commissioner of Public Health for Queensland, the following figures, for the year 1904, are taken :—Rats destroyed, 46,056 ; mice, 27,948 ; examined in the Bacteriological Laboratory, 25,653 (of which 4,922 were mice) ; found infected by plague, 404 (401 rats and 3 mice). The last infected animal was referred to the week ended October 8th.

In addition to the examination of rats at the Bacteriological Institute, material from 64 persons suspected to be suffering from plague was examined during the first half of 1904, the result in 20 instances being reported as positive. The investigation included in every case microscopical tests, making of cultures, and inoculation of animals.

Cairns (population 3,467).—At Cairns two plague attacks, both fatal, came under observation in the early part of 1904, viz., one case in February and another in March, but there was no subsequent developments of the disease.

Ipswich (population 15,246).—A single fatal case of plague was recorded at Ipswich during the month of June. It is stated that two infected rats were found near the premises in which the person attacked had been spending his time for a week prior to his illness. During July and August a few plague infected rats were found at Ipswich, but after this no disease of the nature of plague was found in man or animal up to the end of the year.

Maryborough (population 12,000).—Early in June, 1904, a fatal case of plague in the person of a Chinaman, a cook at a hotel, occurred at Maryborough, a town situated 180 miles north of Brisbane. In the following week a second case, ending in recovery, was reported ; after this there was no further occurrence of the disease during the year. A number of rats were killed, but it is said that none were found infected.

Plague, alleged to have been imported from Sydney, appeared in Queensland first in 1900, and since then the disease has reappeared each year up to the end of 1904. The appended table shows the number of plague cases and deaths reported year by year from 1900 to 1904 inclusive.* Of the total 327 cases and 131 deaths which have been recorded in Queensland during that period (five years) no fewer than 225 cases and 81 attacks have been referred to Brisbane :—

Plague in Queensland.	1900.	1901.	1902.	1903.	1904.	Total in 5 Years
Attacks	136	36	91	29	35	327
Deaths...	57	12	33	17	12	131

* Plague appeared in Queensland also during 1905.

WESTERN AUSTRALIA.

Perth.—In July, 1904, three cases of plague, one fatal, were reported at Perth. During August a single non-fatal case was certified, making a total of four cases and one death from plague at Perth during the year.

No infected rodents had been discovered at Perth from March 20th up to July 30th, 1904, when a single plague infected rat was found. There was no extension of the disease during the rest of the year.

Fremantle.—On August 26th a single case of plague was reported at Fremantle, but there was no spread of the infection. Careful examination of rodents for some weeks failed to find any traces of plague in them.

Western Australia was officially declared free from plague on October 10th, 1904.

NEW ZEALAND.

During April, 1904, two cases of plague occurred at Auckland, one of them proving fatal. Several other cases of illness suspected as plague were also reported, but no epidemic supervened. Plague infection was probably imported from Sydney, no recognised case having occurred in New Zealand since June, 1903. In each of the two bacterioscopically confirmed cases of plague at Auckland it is asserted that the patient prior to his illness had handled dead rats, but it is not definitely known that any of these animals had died of plague. After the two cases of human plague had occurred, systematic examination of rats found dead was instituted, and some 232 rats were bacterioscopically examined. Though the appearances in many of these were suspicious of plague, only one rat was definitely proved to have died of that disease.* At Wanganui, in the Wellington district, an outbreak of fatal disease among rats was observed, but upon careful investigation this was found not to be of the nature of plague.

SOUTH AMERICA.

BRAZIL.

Port Alegre (capital of the State of Rio Grand do Sul) was invaded by plague towards the end of 1903, and the disease continued during the first four months of 1904, viz.: 17 cases reported in January, 33 in February, 20 in March, and 4 in April, a total of 74 cases notified. But this is believed not to represent the full incidence of the disease, for there was a considerable divergence of local medical opinion at first regarding the nature of the prevailing malady, some classing it as "malignant typhus," others as "ataxic fever," and the like. On April 22nd plague was reported as extinct. It is stated that cases in hospital

* Report of the District Health Officer for Auckland; appended to the Annual Report for 1904 of Dr. Malcolm Mason, Chief Health Officer for the Colony of New Zealand.

were regularly treated by injections of Yersin's serum, and in the latter part of the prevalence the mortality, it is said, was markedly diminished by this method of treatment.

Rio de Janeiro.—Plague has persisted at Rio de Janeiro since early in 1900, and the disease continued to occur throughout the whole of 1904. The following table shows the reported cases and deaths at Rio de Janeiro from plague, together with the case mortality, in each of the last five years, viz., 1900 to 1904 inclusive :—

Rio de Janeiro.	1900.	1901.	1902.	1903.	1904.	Total in 5 Years.
Reported plague cases ...	516	384	461	792	682	2,835
„ „ deaths	295	199	215	360	292	1,361
Case mortality per cent.	57·1	51·8	46·6	45·4	42·8	44·4

Notwithstanding the persistent presence of plague in Rio de Janeiro for the last five years, there were found many persons, foreigners as well as Brazilians, who continued to deny that plague has been present in the city. This sentiment largely pervaded the merchants and the shipping class, who scoffed at the idea of a plague epidemic, and regarded all the precautions imposed upon vessels and passengers in the port as an unnecessary interference with trade, organised for selfish purposes by interested officials. It was especially urged that the announcement of the existence of an epidemic was made with a view to find employment for a number young medical men, and to create work for some medical students as sanitary inspectors, as well as to increase the municipal revenues by fees for disinfection. It is, however, needless to refute these allegations. On the authority of the United States official medical representative at Rio de Janeiro, it is stated that at no previous time has the sanitary staff of the city been so skilled and efficient as at present, and that the verification of the diagnosis of plague is carried out with the greatest care and scientific thoroughness.

Notification of plague is compulsory in Rio de Janeiro under a heavy penalty. As soon as a case was notified the house was visited by a member of the sanitary staff; if the clinical symptoms pointed to plague, the case was at once isolated as far as possible at home till a bacterioscopic examination had been made of material from the patient. If the result of this was positive, he received a full injection of anti-plague serum, and was immediately removed to the isolation hospital; the contacts at the house were also inoculated with the serum for prophylactic purposes. The house was carefully disinfected, as also infected articles.

It is understood that no patient was removed to hospital unless the diagnosis of plague had been bacterioscopically confirmed.

The general measures employed in repression of plague comprised steps for destruction of rats and disinfection of the sewers.

It is asserted that in Rio de Janeiro plague prevails during the cool weather, when there is much crowding of the population indoors, and that the disease diminishes during the hot season, when the poorer people live and sleep much out of doors.

The plague epidemic of 1904 extended into the early months of 1905, and a widespread prevalence of small-pox added to the difficulties of the officials.*

Nictheroy (or Nitherohy), a town in the State of Rio de Janeiro, had a limited outbreak of plague in 1904, resulting in 16 deaths; no general epidemic followed.

State of Sao Paulo (population 2,568,779). In this State a number of small outbreaks of plague occurred during 1904, but none of them attained any marked proportions. In the town of *Sao Paulo*, six fatal cases occurred during the year; in *Santos* four deaths; in *Taubate*, on the railway route from Rio de Janeiro to Sao Paulo City, three deaths; in *Pindamonhangaba*, five; and in *Guaratingueta*, nine. Both of the last named are small towns on the railway route from Rio de Janeiro, from which city doubtless the infection was brought.

Bahia, or San Salvador, is a city and seaport in the province of Bahia, and lies some 800 miles N.N.E. of Rio de Janeiro. Its present population is estimated at 265,000. Plague broke out here early in July 1904, and during each month up to December cases and deaths were reported. In all 207 attacks, 141 fatal, came under official notice, a case mortality of 68·1 per cent. The progress of the outbreak here is shown in the table below.

Plague at Bahia.	July.	August.	September.	October.	November.	December.	Total in 1904.
Attacks	35	87	29	29	21	6	207
Deaths...	17	58	22	20	20	4	141

The disease first shewed itself in the squalid and ill kept part of the town, spreading gradually to the better class portion known as the upper city. Of the 207 cases, 49 were whites, 59 were "negros," while 99 were of mixed blood. In a mixed population like that of Bahia, the measures employed by the sanitary authority found little favour, and, as in India, the compulsory removal of the sick to hospital was bitterly resented by the relations and friends. Occasionally armed resistance followed, and in at least one instance firearms were used, and police officers

* No fewer than 3,566 persons died from small-pox in Rio de Janeiro during 1904.

were wounded in the fray. To make matters worse, coincidently with the plague outbreak, smallpox also became epidemic. A considerable number, but not all, of the plague attacks were bacterioscopically confirmed. Some use of anti-plague serum inoculation was made during the height of the epidemic. Concealment of cases helped to spread the infection. At the time of the appearance of plague in July, and throughout that month, careful search was made to ascertain if the local rats were infected; but, it is said, with negative results.

At *Valença*, a small seaport town south of Bahia, four suspected plague cases occurred in July on board a small sailing vessel, but no definite report on this occurrence has been received.

Pernambuco, or Recife (population about 200,000), is the capital of the province of that name. Plague had been present in Pernambuco from 1901 to 1903. Early in 1904 a few cases were reported, after which nothing more was heard of the disease till August, when a few more cases were notified. From August to October four deaths from this cause were certified. The first of these deaths was that of Dr. Silva Leal, a medical man employed in the Sanitary Service of Pernambuco. The attack of this medical man seems to point to existence of previous unrecognised or unreported cases of plague in the town or district. The officially reported details of plague in Pernambuco are exceedingly scanty, consequently it is not possible to state the amount of the disease which prevailed there during 1904.

In a report * submitted to the Demographical Bureau of the Sanitary Section of the Scientific Congress of Latin American Countries, it is stated that in 1901, 1902, and 1903, the deaths from plague in Pernambuco numbered respectively 22, 126, and 66. The number for 1904 is not given.

Para or Belem, the capital of the province of Grao Para which is traversed by the Lower Amazon, was invaded by plague towards the end of 1903, the disease continuing to manifest itself during January, February, March, and April, 1904. In May the town was free from plague and no further cases were reported until December when five mild attacks were notified. Altogether, so far as can be learned from the meagre reports available, some 32 plague cases were notified during 1904. Of 21 of the cases treated by inoculation of Yesin's serum, 14 recovered. A considerable amount of prophylactic inoculation was practised. Measures for destroying rats were vigorously carried out; disinfection of infected houses and effects was thoroughly done; the sick were isolated and action was taken for improving the general sanitary condition of the city. It is believed that the vigorous execution of all of these measures was instrumental in preventing the development of a plague epidemic in Para.

Maranhao (Maranham or Sao Luiz), a seaport of some importance in North Brazil was also infected by plague about the end of 1903, cases continuing to be reported during the early part of 1904. But the local authority proved very reticent and little

* United States Public Health Reports, September 22, 1905.

information was made public concerning the outbreak. It was believed, however, by persons residing at Para that more plague cases and deaths had occurred at Maranhao than at Para.

PARAGUAY.

Asunçion.—In the Autumn of 1904 rumours were rife that plague had broken out again in Asunçion, the last appearance of the disease having been observed in the Autumn of 1902. These rumours appearing in the public press remained unconfirmed by the Paraguayan Government. It was asserted by the Belgian Consul on October (in the Belgian official "Bulletin Sanitaire" of October 20, 1904) that, though the authorities refused to admit the existence of plague in Asunçion, there were occurring some 20 cases weekly, half of them fatal, It was also stated that the National Health Department was supplying medical men with anti-plague serum, and that 20 centavos were given for every rat or mouse delivered to the sanitary officials. The notification of plague was also made compulsory under penalty. No official report or statement, however, has been made public as regards an outbreak in 1904 by the Government of Paraguay.

ARGENTINA.

The information as to plague in Argentina is somewhat scanty, but from statements published from time to time in the weekly issue of the United States Public Health Reports, it appears that plague, mostly as scattered cases, occurred in the following provinces during 1904, viz., Buenos Ayres, including the city of that name, Entre Rios, Santa Fé, Salta, Tucuman, Santiago del Estero, Cordoba, Pampa, and San Juan. The largest outbreak took place in the Salta Province. It is believed that plague infection was originally brought to Salta from Chili, where the disease was prevalent. Plague showed some tendency to spread in Argentina during the first four months of 1904, but from April to October very little was heard of the disease. In the latter month it appeared again simultaneously in a number of localities and at the end of the year was still manifesting itself in the Provinces of Salta, Buenos Ayres, Santiago del Estero, and Entre Rios, though not in marked epidemic form. Owing to the scantiness of the reports on Plague in Argentina which have reached this country it is not possible to give here any statistics as to the amount and fatality of the disease in that country during 1904.

CHILI.

Plague continued to show itself in Chili during 1904, as it had done in 1903, the chief localities invaded being Antofagasta, Arica, Iquique, Santiago, and Valparaiso. The former of these places, Antofagasta, with a population of about 16,000, was most severely affected. In May and June, the certified plague deaths numbered 63, but full details of the outbreak have not been received. The disease appeared in April, and subsided in July, though cases again were reported in October.

PERU.

Plague persisted in Peru throughout 1904. The disease had appeared in Callao in May, 1903, and the ports of Pisco, Pacasmayo, and Mollendo were also invaded. These manifestations of plague were not on a large scale. But in 1904 the places invaded became very numerous, especially along the coast from the extreme north of Peru to its southern border. Among the localities invaded were Payta, Piura, Sechura, Colan, and La Sullana, in the department of Piura; Lambayeque, Chiclayo, and Eten, in the department of Lambayeque; San Pedro, Pueblo Nuevo, Pacasmayo, Guadalupe, Huanchaco, Salaverry, and Trujillo (or Truxillo) in the department of Libertad; Matucana and Lima, the capital of Peru, with a population of 130,000, in the department of Lima; Callao, in the province of that name, and the chief port of Peru; and Mollendo, in the department of Arequipa.

There are no official reports available showing how many persons were attacked by plague in each of these localities during 1904, or how many deaths occurred during the epidemic. But the British Consul-General, in his report to the Foreign Office, states that since the beginning of the outbreak, up to the end of 1904, there had been reported in Peru 1,110 cases and 558 deaths from plague. He adds, "Many more cases must have escaped detection, as there has always been an extreme disinclination on the part of the poorer classes to avail themselves of the medical assistance given in the lazarettos, although it is considered that in the Lima lazaretto especially the treatment of plague has been successful. The Lima local administration deserves credit for the manner in which it has coped with the evil, but the hygienic condition of all the towns still leaves a good deal to be desired." The general measures employed to combat plague included isolation, observation, and disinfection, together with destruction of rats and mice; also sanitary inspection of the houses of the poor, inside which many persons raise large numbers of guinea pigs. The authorities considered it advisable to kill a large number of these animals. For curative purposes, Yersin's serum was largely used with, it is said, gratifying results. It is reported that, coincidently with the outbreaks of human plague, unusual mortality among rats was observed at Eten, Pacasmayo, Salaverry, Trujillo, Lima, Callao, and elsewhere. It is asserted that plague was conveyed in Peru from port to port by means of ship rats.

ECUADOR.

In August, 1904, a report was received by the Superior Board of Health that unusual mortality among rats had been observed on the island of Puna, which lies about 36 from Guayaquil, the chief seaport of Ecuador. It appears that suspicion of plague among the rats had arisen from the fact that one of them showed enlarged glands. Suspected rats were then subjected to a bacterioscopic examination, which, however, is said to have negatived the diagnosis of plague.

MEXICO.

No actual plague outbreaks were reported in Mexico during 1904, though in 1902 and 1903 the disease had existed in the country. But a suspicious outburst of what was designated "*epidemic pneumonia*" occurred in May, in the State of Sinaloa, near Mazatlan, a town which had suffered from plague in 1902 and 1903. No detailed reports of this epidemic have reached this country, but the fact that the outbreak appeared near a town in which during the previous year plague had been prevalent, gives rise to suspicion as to the identity of the disease.

UNITED STATES OF AMERICA.

San Francisco.—Early in 1904 several plague cases were reported in San Francisco, the last previous cases having been notified in November, 1903. Up to the beginning of March, 1904, 10 cases had come under observation, 3 in January, 6 in February, and 1 on March 1st. Of these 10 cases, 8 were bacteriologically confirmed, and all 8 were fatal. The two unconfirmed cases recovered. During the rest of 1904 no further attacks came under observation.

Careful investigation was made week by week as to the occurrence of plague in rats. During the whole of January no plague infected rats were discovered out of 230 which were submitted to bacterioscopic tests, although three human cases were reported, and the diagnosis of these was confirmed in the laboratory. During February, out of 221 rats examined, seven were found infected by plague; and in March, out of 260 which were bacteriologically investigated, only one was found to be suffering from plague. Examination of rats was maintained during the rest of the year, but on one occasion only was infection discovered, and that in a single rat at the end of May.

For purposes of rat destruction Danysz virus was extensively used, as well as other means, including trapping. It was publicly stated that the local authorities intended to continue systematic destruction of rats for two years, with a view to diminishing the chances of future development of the disease.

San Francisco was first infected by plague in 1900, and in that year 22 human attacks (all fatal) were recorded; in 1901, 30 cases and 25 deaths; in 1902, 41 cases, all fatal; and in 1903, 17 cases, all fatal.

Concord (California). An Irish American woman who was pregnant fell ill at Concord (Cal.), on February 24th, 1904, with acute symptoms, including vertigo, nausea, and fever, together with a painful swelling in the armpit. She was delivered of a six or seven months' child on February 28th, and died the next day, February 29th. Material from the axillary swelling was taken for examination by Drs. Lloyd and Neff, who provisionally

diagnosed plague, which diagnosis was subsequently confirmed by the San Francisco experts. The infection was probably received at San Francisco. No further case of the disease followed at Concord during the year.

ENGLAND AND WALES.

Seventeen ships were reported during 1904, on arrival in English and Welsh ports, as technically infected by plague or as having on board cases of illness suspicious of plague. In only two instances, particulars of which will appear later on, was the diagnosis of plague confirmed by the Boards' bacteriologist. In respect of 10 ships the diagnosis of plague was negatived by bacterioscopic investigation. In five of the other instances the suspicious illness had occurred during the voyage, the patient having been landed at a foreign port (Suez and Aden) or buried at sea.

The main facts of these 17 vessels are given in tabular form below. Twelve had sailed from Indian ports; four from South America; and one from South Africa. Six of them arrived in the Thames; six at Liverpool; and one each at Southampton, Cardiff, Barry, Holme Cultram, and the Tyne.

With regard to the two ships, each of which landed an actual case of plague at an English port, the circumstances of each deserve special mention.

(1) s.s. *Bishopsgate*.—This vessel left Rosario on July 22nd for Hamburg with a cargo of maize, wheat, and bran, having on board a crew of 20 men and six officers, most of them Germans. She touched at St. Vincent (Cape de Verd Islands) on August 10th and arrived all well at Hamburg on August 29th, no sickness having occurred on the voyage. The majority of the crew were at once paid off, but the master, two mates, three engineers, and two seamen remained on board. The unloading was begun at once, and on September 6th, while the cargo was being discharged, two dead rats were found in one of the holds. These rats were at once sent to Dr. Nocht's laboratory for examination, which showed that they had suffered from plague. On September 7th discharge of cargo was stopped, and the vessel was taken to the mooring station, where it was fumigated by the method of Nocht and Giemsa for the destruction of rats, from 20 to 30 of these rodents being found dead on completion of the process. After this, unloading of the vessel was completed on the morning of September 14th; disinfection of holds and cabins being undertaken on that and the following day by the port sanitary officers by means of SO_2 cylinders, followed by thorough scrubbing and limewashing of holds and cabins. The sweepings of refuse from the holds (no doubt containing rat excrement), along with damaged sacks, were not burnt or otherwise disposed of. The throwing of such articles overboard in the port of Hamburg being forbidden, these were stored in a corner of

TABLE giving particulars of 17 SHIPS which arrived in Ports of England and Wales under SUSPICION of being infected with PLAGUE; giving also their Names, Ports of arrival, Dates of departure and arrival, Number of cases, and the results of Bacterioscopic investigation where that had been carried out.

Number.	Name of Vessel.	Port of Arrival.	Date of Arrival.	Port of Departure.	Number of Suspected Cases.	Result of Bacterioscopic Examination if any.	Remarks.
			1904.				
1	S.S. *Dalmatia*	The Thames ..	January 27 ..	Calcutta	1	Negative.	
2	S.S. *City of Delhi* ..	Liverpool ..	„ 29 ..	Karachi	1	„	
3	S.S. *Walmer Castle* ..	Southampton ..	„ 30 ..	Cape Town ..	1	„	
4	S.S. *Knight of the Garter.*	Liverpool ..	February 2 ..	Bombay	2	„	One patient landed at Suez; another suspected case found on arrival at Liverpool, but diagnosis disproved by bacteriological examination.
5	S.S. *Gibraltar* ..	Barry	March 19 ..	„	1	None made.	Patient died on February 3rd, during the voyage four days after leaving Bombay.
6	S.S. *Persia*	The Thames ..	„ 24 ..	„	1	Not stated.	Patient was landed at Aden on March 4th.
7	S.S. *Knight of the Thistle.*	Cardiff	„ 30 ..	„	1	Positive.	At Suez, where patient was landed on March 9th.
8	S.S. *Pekin*	The Thames ..	May 6 ..	„	1	Negative.	
9	S.S. *Olaf*	Holme Cultram	„ 26 ..	Rosario	1	„	
10	S.S. *Bavaria*	The Thames ..	June 10 ..	Calcutta	1	None made.	Suspected case during the voyage, fatal, and buried at sea before reaching Colombo.
11	S.S. *Clan McLeod* ..	Liverpool ..	„ 21 ..	Bombay	1	Negative.	
12	S.S. *Malta*	The Thames ..	July 9 ..	„	2	„	
13	S.S. *Circassia*	Liverpool ..	„ 23 ..	„	1	Not stated.	Patient was landed at Suez.
14	S.S. *Bishopsgate* ..	The Tyne ..	September 19 ..	Rosario	1	Positive.	See page 265.
15	S.S. *Merton Hall* ..	Liverpool ..	October 22 ..	Karachi	1	Negative.	
16	S.S. *Weybridge* ..	The Thames ..	November 30 ..	Colostina	1	Positive.	See page 268.
17	S.S. *Conway*	Liverpool ..	December 17 ..	Santos	1	Negative.	

one of the holds plentifully covered, it is said, with a coating of limewash, orders being given that the refuse and the sacks were to be thrown overboard when the ship had left the Elbe and was well out at sea.

The *Bishopgate* left Hamburg on September 17th in water ballast, carrying three passengers. The master, before sailing, received a certificate from the Port Medical Officer of Hamburg to the effect that the vessel had discharged its cargo and was "totally free from rats either dead or alive," that all the holds had been disinfected, and that there was "no further fear of infectious sickness existing." On September 18th, the day after leaving Hamburg, the sweepings and damaged sacks already mentioned were thrown overboard, and the same night the boatswain complained of illness; he felt sick and vomited; he had headache and pains in his back and chest. Next day, September 19th, the ship arrived in the river Tyne, and the master reported all well; but the same afternoon the Port Inspector of Nuisances visited the vessel, which was then moored in the docks at South Shields, and found that the boatswain was ill. This fact he reported to Dr. Harker, the Port Medical Officer of Health, who visited the patient and discovered that, in addition to high fever and delirium, he had a bubo in the left groin. He was accordingly removed to the Port Hospital, where material was taken from the swollen gland and sent to the Local Government Board for examination. The cabin occupied by the sick man was disinfected with sulphurous acid, and all persons on board were medically examined by Dr. Harker and found well. As a precautionary measure, while the bacterioscopic investigation was proceeding, all articles found in the boatswain's cabin were disinfected. No trace of rats was found on board. Dr. Klein's bacterioscopic examination of the material from the bubo confirmed the suspicion that the man was suffering from true plague.

The circumstances under which this case of plague arose are somewhat exceptional. So far as official notification goes, no human plague occurred at Rosario during 1904, nor had there been any plague infection observed there among rats or mice—at least no information on the subject has been made public. There had been no sickness on board the vessel during the voyage from Rosario to Hamburg; and it was only at an advanced stage of unloading cargo at the latter place that two dead infected rats were discovered. After this the ship had been fumigated for the purpose of rat destruction and afterwards disinfected. The plague patient was not a member of the old crew, but was engaged at Hamburg while the vessel was discharging there. He took part in the cleaning up of the ship before it sailed for the Tyne. It can only be surmised that he became accidentally inoculated with plague possibly through infected rat excrement coming in contact with some abraided surface of the skin of the hands or feet during the cleansing process in the holds just prior to leaving Hamburg. The fact that the boatswain took part in throwing overboard the collected refuse sweepings and damaged sacks on September 18th can hardly account for his illness since the acute symptoms appeared

the same night. There was no subsequent development of plague infection in connection with the *Bishopsgate*, which sailed on September 22nd for Chittagong.

(2) The S.S. *Weybridge*, carrying a grain cargo, and having a crew of 22, left Colastine (otherwise known as Colostina or Calastino) an Argentine port in the River Plate, on October 13th, 1904, touching at Rosario on the same day, and at St. Vincent (Cape de Verd Islands) on November 12th, at Ferrol (Spain) on November 23rd, remaining there till November 25th, and reaching the mouth of the Thames on November 30th. The master reported that on November 25th, while at Ferrol, a member of the crew, a Spaniard, employed as a coal trimmer, complained of illness for which the master gave him some medicine. Next day, November 26th, the man was worse and a swelling appeared in the groin; thereupon a doctor from Ferrol was brought on board to see him and expressed the opinion that the man had contracted a "chill." He ordered the swelling to be painted with iodine. The ship then sailed for the Thames. When inspected on arrival by the London Port Medical Officer of Health the sick man was obviously very ill (temperature 102·8 F.; expression dull and anxious; respiration hurried; tongue furred; gland in groin very painful to the touch). Gland juice was taken at once from the swelling and sent to the Local Government Board for bacteriological examination. The patient was landed at the Port Hospital (at Denton) and the quarters he had occupied were disinfected as well as his clothing and effects; the other usual precautions were taken. Afterwards fumigation of the ship by burning sulphur was carried out except as regards the holds, engine room, and bunkers.

Enquiry showed that there had been no other cases of recent sickness on board, nor was plague or suspected plague known to have existed at the Port of departure or at any of the ports of call. There was a vague story of dead rats having at one time (date uncertain) been found on board. The master said that the vessel had been fumigated with sulphur at Buenos Ayres on June 11th, 1904, and that 14 dead rats had then been found.

Dr. Klein, the Board's bacteriologist, reported that his investigations proved the case to be positively one of plague.

The vessel had been allowed to proceed up the river to the docks after precautionary measures which had been taken. Fumigation was now again carried out by means of the Clayton process at the expense of the owners; the engine room, bunkers, holds, forecastles, and forepeak all receiving special attention. The first fumigations done by the Port Sanitary Officials resulted in the destruction of 132 rats, while the fumigation carried out by the Clayton Company was responsible for 144 more, making a total of 276 rats destroyed after arrival in London Port. There was no evidence to show that any of the rats were suffering from plague.

The patient recovered and there was no extension of the disease to other persons. On December 9th the *Weybridge* left London for a Welsh port to load coal.

As to how this man contracted plague it is not possible to say. But it is not unlikely that if there had been rat plague on board the *Weybridge* at some time when she was in the River Plate the man in question may have become accidently inoculated through some abrasion of the skin by infective material (rat excrement or the like) while engaged in his work in the bunkers or holds, probably at the time when preparations were being made in anticipation of the vessel shortly reaching its port of destination. It is alleged that the man had been catching rats with his hands.

During 1904 no suspected cases of plague on shore were reported to the Local Government Board.

In the subjoined table will be found a summary of the number of reported plague and suspected plague cases on board ships arriving at English and Welsh ports, as well as those reported as occurring on shore, during the last six years. From this it may be seen that notwithstanding the widespread prevalence of plague throughout the world, especially in countries with which Britain has frequent and continued communication by means of shipping, there has been practically no importation of plague into our seaports. In the isolated instances which have occurred, the local authority has been able to deal with them in a satisfactory manner.

Year.	Shipborne plague and suspected plague.		Plague and suspected plague on shore.		Total.	
	Number of instances reported to the Board.	Number of instances in which diagnosis of plague was confirmed by bacteriscopic investigation.	Number of instances reported to the Board.	Number of instances in which diagnosis was confirmed by bacteriscopic investigation.	Instances reported.	Diagnosis confirmed by the Bacteriologist.
1899 ...	7	—	2	—	9	—
1900 ...	23	4	9	—	32	4
1901 ...	33	4	13	2*	46	6
1902 ...	21	1	1	—	22	1
1903 ...	9	—	2	—	11	—
1904 ...	12	2†	—	—	12	2
Total...	95	11	27	2	132	13

* Case at Cardiff, and group of cases at Liverpool.

† Another case bacteriscopically confirmed occurred on a British bound ship before it reached Suez, where the case was landed and the ship disinfected.

FRANCE.

Havre.—So far as is known no plague occurred in France during 1904; but a very suspicious group of imported cases of illness comprising five attacks and four deaths were referred to the port of Havre. The S.S. *Clan MacArthur* arrived at Havre on May 23rd from Calcutta and Bombay, having touched at Suez, Port Said, and Malta. No illness of a suspicious kind was observed on board during the voyage, which began on March 20th, till the ship left Malta, when a lascar fell ill (on May 17th) and died two days later (May 19th). According to the master's account the lascar had some hemorrhage from the mouth and a swelling in the groin. On May 22nd, the day before reaching Havre, a fireman fell ill, but the port medical officer, on examining him, did not find it necessary to take any precautions regarding him. He died on May 24th, his death being regarded as due to pleurisy. On May 24th another fireman became ill with sore throat and swollen cervical glands, and was taken to hospital where he died on May 27. There was no post-mortem examination of any of the cases. Some bacterioscopic investigation was, however, made as suspicion had arisen as to plague owing to these three deaths among the *Clan MacArthur's* crew; but nothing definite as to plague was found. The cause of death was entered in the log as "Inflamed ligaments of the throat, case suspicious." On May 25th the chief steward became unwell and was visited by the Port Medical Officer, this illness being also entered in the log as "inflamed ligaments of the throat, case suspicious." The steward was then removed to hospital on shore, where he died on June 3rd. No post-mortem examination appears to have been made, though bacterioscopic investigation was carried out with inconclusive results. The microscopical characters of the micro-organism found in the material from the steward are said to have appeared similar to those of plague, but the investigation was not continued by experiments on animals in a way to arrive at a definite diagnosis.

On May 26th a native quartermaster on board the *Clan MacArthur* complained of nervous depression and diarrhœa. He was removed to the hospital, but was able to return to the ship on May 30th. The symptoms in this case were somewhat different from those of the others of the series, and it is possible that the illness in this last instance was not the same as that of the four others of the group.

The cargo of the *Clan MacArthur* consisted of cereals and coffee. After discharging the ship was disinfected, and when this had been completed three or four dead rats were found. A bacterioscopic examination of the bodies was made, but the results were, as before, inconclusive, and the diagnosis was "reserved." There had been no observed illness among rats on board during the voyage. Any rats seen alive appeared to be well and active. It may be noted that while the ship was being disinfected at Havre a fire occurred on board due, it was said, to the methods employed in the disinfection. Finally, the vessel left Havre in ballast for Glasgow Port on June 2nd arriving off Greenock on June 5th.

Though not confirmed bacterioscopically the disease from which the four persons died was in all probability plague. It is a matter of regret that the bacterioscopic examination was not fully carried out so that the diagnosis might have been definitely established.

GERMANY.

There were no actual human plague cases reported in Germany during 1904, but several ships came under suspicion while unloading at German ports owing to the finding of dead rats on board. (1) s.s. *Bishopsgate*, which arrived at Hamburg on August 29th, having left Rosario on July 22nd, with a cargo of maize, wheat, and bran. There was no sickness on board during the voyage. On September 6th, during the unloading, two dead rats were found, and these, when examined bacterioscopically, showed that death had resulted from plague. Later others were found, and altogether 129 rats were examined, and of these nine were proved to be infected by plague. The ship was taken to the mooring station and fumigated by the Nocht and Giemsa method for destruction of rats, but only 20 to 30 of these animals were found after completion of the process. Unloading was then continued up to September 14th, when disinfection of the holds and cabins was undertaken by means of sulphur fumes, followed by scrubbing and limewashing. A new crew was shipped, and the *Bishopsgate* sailed from Hamburg for the Tyne on the 17th September. On the following day the boatswain was attacked by illness, which, on arrival at South Shields (Tyne Port), was found to be plague (*see* page 265). (2) On the English steamer *Blagdon*, from San Nicholas (River Plate), while unloading grain at Hamburg, dead rats were found, and these, on bacterioscopic examination, proved to be plague infected. The *Blagdon* had left San Nicholas on October 7th and arrived at Hamburg on November 14th, and the infected rats were found on November 23rd after the largest portion of the cargo had been discharged. The ship was at once submitted to the fumigation by "Generator" gas (Nocht and Giemsa's method). After this 107 dead rats were found, seven of which were plague infected. On November 28th the vessel was freed from restrictions; no case of illness was observed among the crew or the dock labourers who helped to unload the cargo. The other ships which came under suspicion of being infected by plague stricken rats were (3) s.s. *Hatasu*, in the port of Geestemünde in January, but bacteriological investigation of dead rats sent to the Bremen Hygienic Institute showed that the animals had not suffered from plague. Another instance (4) was a ship (name not given) which arrived in September at Hamburg from West Africa. Dead rats were found when the cargo of bananas was being unloaded, but bacteriological investigation proved that the rats had not died from plague. Another instance occurred in December at Stettin, where (5) the s.s. *Daybreak*, from Buenos Ayres, fell under suspicion through the finding of a single dead rat, which, on examination at the Berlin Bacteriological Laboratory, was reported to be free from plague; a week later a second dead rat was found, and this again, on bacterioscopic examination, was found to be free from plague. The finding of these two dead rats

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on board the *Daybreak* led the Stettin police authorities to impose very stringent measures on the vessel, which had to cease unloading on both occasions for some days while the bacteriological investigation was being carried out, so that altogether 10 days were lost—involving a loss on the owners of at least £300.

PORTUGAL.

During the latter part of 1904 rumours became rife that plague had reappeared in Oporto, and some newspaper reports spoke somewhat confidently in confirmation of these rumours, giving specific instances where, among others, a medical student had died of plague after accidental inoculation while making a post-mortem examination. Ultimately, to meet these allegations, an official notice was published by the Portuguese Government explaining that some cases of infectious pneumonia had occurred in December at Oporto, but that all necessary precautions had been taken. The case of the student referred to above was explained by the medical journal *Medicinia Contemporanea* to be one of blood poisoning from a dissection wound, and was not due to plague.

RUSSIA.

Kronstadt.—On January 16th, Dr. Tourtchinovitch-Vyjnikevitch, Director of the Imperial Institute of Experimental Medicine (where anti-plague serum was being prepared), was attacked by illness, which, on bacterioscopic investigation, proved to be plague. From this he died four days later (on January 20th) in spite of energetic treatment and repeated inoculations of anti-plague serum. The laboratory is established in the Emperor Alexander I. Fort, which is situated on a small island about three miles from the southern coast of the Gulf of Finland, and near Kronstadt. When it became known that the director had been attacked by plague, due to accidental inoculation with a plague culture, all persons who had been in contact with him, including all those employed in the laboratory, were at once inoculated with anti-plague serum, and all the usual precautions were taken. The facts relating to the case were communicated to the British Ambassador at St. Petersburg by the Minister of Foreign Affairs, in accordance with the terms of the Venice Convention of 1897.

Although it has been stated in a London newspaper that two medical assistants in the Imperial Institute Laboratory were subsequently attacked by plague, no confirmation of the statement has been received from official sources.

Ural Territory.—Nothing more was heard of plague in Russia until December, when information* was received from the Ural Territory that an epidemic had occurred there in the two stanitzas of Yamankhaleinsk and Saraïtchikovo, in the district of Gourieff, beginning in mid November first among the Khirghise inhabitants and afterwards extending to the Cossack population. During the period of four weeks ended December 26th it is said that 190 persons died from plague, and in the week following 97 more victims succumbed to the epidemic. It is stated that the type of

* Journal de St. Petersbourg, December 29th, 1904.

the disease was pneumonic. The outbreak continued to prevail in the Ural Territory till February, 1905, some 350 deaths being officially reported. In spite of free use of Yersin's serum curatively, the case mortality was unusually high. The invaded territory which comprised three villages and nine groups of huts and fishing communities, was surrounded by a double guard of Cossacks with the object of preventing the spread of the infection to adjoining villages. Medical men from St. Petersburg were dispatched to the invaded locality, and a skilled bacteriologist was obtained from the adjoining Government of Astrachan.

Viatka.—In October an outbreak of "Siberian plague" was reported in the districts of Viatka and Slolodskoi, in the Government of Viatka in European Russia. It is stated that between October 18th, 1904, and January 3rd, 1905, about 300 cases were notified. The German Official Journal of Public Health* regards this outbreak as one of anthrax, the term "Siberian plague" being another name for that disease. It is possible that this may be correct, for in the *Times* of December 20th, 1904, it is stated that the illness in question was traced to sheep skins used in the manufacture of fur garments, and that the cases occurred among the workers in 45 different factories.

Odessa.—In the annual report for 1904, to the Foreign Office, of the British Consul at Odessa, it is stated that on board four British and two Russian steamers there were found "several rats, which, on investigation, showed clear evidence of being infected with plague." No particulars, however, are given as to the names of the ships or the ports from which they had sailed. Apparently there were no recognised human cases of plague at Odessa in 1904.

TURKEY.

Smyrna.—In this seaport town there have occurred during the last four years scattered cases of plague, viz., in 1901, four cases; in 1902, two; in 1903, two; and in 1904, six certified cases. But it is affirmed, by persons who are in a position to know, that all cases were not officially reported, and that some instances were spoken of merely as "suspected plague." Of the six certified cases in 1904 four proved fatal; the first was notified on September 2nd, during which month four other cases of possible plague came under observation. The diagnosis in the three earliest cases was confirmed bacteriologically.

Trebizond.—In mid December, a fatal case regarded as plague was reported; but the body had been buried before the order came from Constantinople that a bacterioscopic examination of material from the deceased was to be made. It is alleged that as some decomposition of the body had taken place, the results bacteriologically were not definite. There was a difference of opinion among the experts, some maintaining that the results warranted a diagnosis of plague, while others refused to admit this. Nothing was known as to the origin of the case; no further occurrence of the disease was reported.

* Veröffentlichungen des Kaiserlichen Gesundheitsamtes.

Beirut.—In November a single plague case was notified as having occurred on board the Austrian s.s. *Elektra* from Alexandria and Port Said. The patient was landed at the lazaret, where he ultimately recovered. The positive bacterioscopic results in this instance were confirmed by Professor Calmette of Lisle, who chanced at the time to be paying a visit to Beirut. There was no spread of the disease. The ship was disinfected, and some rats, which were asphyxiated during the process, were examined bacterioscopically, but with negative results.

EGYPT.

During 1904 the total plague cases officially reported amounted to 854, and the deaths to 501, a case mortality of 58·6 per cent. The following table shows the distribution of the cases and deaths throughout the various towns and districts of Egypt.

Province.	Town or District.	Plague.	
		Cases.	Deaths.
	Alexandria	108	70
	Port Said	22	16
	Damietta	2	2
	Suez	11	5
Guirgueh	Guirgueh	39	36
„	Zahta	39	26
„	Baliana	83	61
„	Sohag	1	—
Kena	Nag Hamadi	92	65
„	Dechna	42	40
Assiout	Assiout	1	—
Minieh	Samallout	199	89
„	Beni Mazai	4	3
„	Maghagha	1	—
„	Minieh	1	1
Beni Souef	Beni Souef	17	10
„	Beba	47	17
Menoufieh	Kouessna	3	1
„	Chibine El Kom	12	4
„	Achmoun	11	6
Behera	Abou Hommos	1	—
Charkieh	Zagazig	95	37
Toukh	Toukh	23	12
Total for the whole of Egypt		854	501

The amount of plague in Egypt during 1904 has been considerably in excess of that of any year since the recent recrudescence of of plague in the east, as may be seen in the subjoined table.

Egypt.	1899.	1900.	1901.	1902.	1903.	1904.
Plague attacks	95	127	206	481	303	854
Plague deaths	45	57	104	291	160	501
Case mortality, per cent.	47·3	45·0	50·7	60·5	52·8	58·6

ADEN.

In 1900 plague was epidemic at Aden, and during that year 708 cases and 576 deaths were reported. Since, with the exception of occasional imported cases, Aden has remained free from plague.

In January, 1904, a single fatal case of suspected plague occurred, followed by three other suspected cases in March. In May, five plague cases came under observation, but there was no epidemic. In July two cases were reported, and one in August. No further attacks were certified till the beginning of November, from which time till the end of the year 230 cases of plague, with 172 deaths, occurred; making, with the earlier sporadic cases above mentioned, a total for the year of 242 cases and 176 deaths. The distribution of these month by month throughout the year is shown in the tabular statement below.

Aden, 1904.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Plague attacks ..	1	—	3	—	5	—	2	1	—	—	44	186	242
„ deaths ..	1	—	—	—	2	—	1	—	—	—	26	146	176

This epidemic extended into the earlier months of 1905, yielding up to March 4th 1798 additional cases, with 1572 deaths.

GERMAN EAST AFRICA.

At the end of 1903 reports were received that an illness suspiciously resembling plague, designated by the natives "Kyambafu," had broken out at Iringa, in the neighbourhood of a German military station situated some 30 days' march from the coast. This illness was characterised by swollen glands with fever, and

many of the patients had pneumonia. Simultaneously a marked mortality among rats is stated to have been observed. From January 1st to March 1st, 1904, some 47 serious cases came under observation, and of these 41 died. Some cases were reported from the Catholic Mission Station at Tosamaganga, situated 2½ hours' march from Iringa. Three Europeans, two sisters of mercy, and a priest were attacked, both of the sisters succumbing to the disease. Bacterioscopic examination proved the presence of true plague.*

The natives asserted that similar illness appeared almost every year; and this is not unlikely, as the locality mentioned lies within what is regarded as a plague endemic area, which includes portions of German and British East African territory lying to the west of Lake Victoria Nyanza.

In May a single fatal plague case occurred on board the government steamer *Sybil* at Bukoba, but no extension of the disease appears to have resulted from this case.

MOZAMBIQUE.

For some time the Portuguese authorities had carried out a medical inspection of all passengers arriving from the Transvaal by rail. On July 18th, 1904, a native was found among the arrivals at Lorenzo Marques to be suffering from illness suspicious of plague. He was isolated at San Jose de l'hangnene, about five miles outside the town, where he died. It is stated that the post-mortem examination and bacteriological investigation confirmed the diagnosis of plague. No extension of the disease supervened from this case. But at the beginning of November, four suspected cases of plague, 2 of them fatal, were reported at Maguda, where in 1903 similar cases occurred. There was apparently no spread of the infection in Maguda during 1904 from these cases, though in January, 1905, a group of five more suspected cases was reported.

TRANSVAAL.

Johannesburg and District.—In mid-March 1904, suspicion arose that a number of sick persons in the coolie location at Johannesburg, suffering from pneumonia, were in reality ill with plague. Unfortunately, at the time that this occurred, Dr. Chas. Porter, the Medical Officer of Health, was ill with typhoid fever. Before his illness began, however, he had already prepared a plan of campaign should plague invade Johannesburg. So soon, therefore, as it became known that suspected plague cases had occurred, the arrangements devised by Dr. Porter were put into force by Dr. Walter C. Pakes, who was acting temporarily as Medical Officer of Health. Bacteriological investigation confirmed the diagnosis of plague, and in consequence immediate action was taken.

* Veröffentlichungen des Kaiserlichen Gesundheitsamtes, July 6th, 1904.

Altogether up to the end of July some 149 cases and 97 deaths from plague were reported in and around Johannesburg. But on August 13th the Transvaal was officially declared to be free from the disease. Of the figures given above, it appears that 112 cases and 82 deaths were referred to the town of Johannesburg.* It is thought more than probable that some fatal cases of pneumonia among natives and coolies, before the recognition of the epidemic, were due to plague, and in that case the figures given above do not represent the total amount of the disease at Johannesburg and district in 1904.

There does not appear to have been anything resembling an epidemic among the local rats before or during this plague outbreak. The precise origin of this prevalence of plague in Johannesburg has not been traced to any definite source, though infected forage imported from Cape Colony was suggested by some persons as the probable source.

The coolie location that became invaded, and which was in an insanitary condition, having been previously condemned by Dr. Porter, was evacuated, and some 3,100 persons were removed to a segregation camp outside the town. Only one fatal case of plague occurred in this camp during the 24 days following the removal of the coolies. The abandoned location was burnt to the ground after due precautions had been taken. After a period of 12 days' detention in camp, the coolies, under certain restrictions, were allowed to come and go between the camp and the town. Other measures comprised early notification of suspected cases, removal to hospital and complete disinfection of articles and places. Employers of native labour were required to call in medical assistance to any sick native within 24 hours of his falling sick. No Asiatic was allowed to travel unless provided with a medical certificate of his being in good health. A large staff of special inspectors and disinfectors were engaged; medical men with previous plague experience were also employed.

* The racial distribution of these is as follows:—

——	Cases.	Deaths.
Whites	24	12
Indians	55	52
Coloured	4	1
Natives	29	17
	112	82

CAPE COLONY.

In Cape Colony plague was present throughout 1904, but only in sporadic form. Altogether 57 cases and 25 deaths were reported in the Colony. No plague in man or rats was found in *Cape Town*. Some 31,138 rats were examined during the year in the Harbour district and in the municipality without a single rodent being found infected by plague.

In *Port Elizabeth* 53 cases, 23 fatal, were reported, distributed throughout the year as shown in the following table :—

Plague in Port Elizabeth.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Reported attacks	2	—	12	4	4	3	9	4	5	3	5	2	53
„ deaths	2	—	8	2	—	1	4	2	1	1	2	—	23

The case mortality was 43·4 per cent.

Plague infected rodents were found in Port Elizabeth throughout the year; in no month did plague-infected rats fail to be discovered. But the effect of this rat infection does not appear to have been severe since no epidemic arose.

In *East London* a single fatal plague case was discovered in January, but there were no subsequent cases throughout the other eleven months of the year, although plague-infected rodents were found in January, February, March, April, July, August, September, October, November, and December. So that, although plague was present among rats throughout ten months of 1904, apparently this had no influence in causing the spread of plague to man.

At *Kynasna* some plague-infected rodents were found in January, but no human plague occurred.

At *Queenstown* rats were discovered infected by plague in January and February, but no human plague cases supervened.

At *Grahamstown*, in May and June, plague-infected rodents were discovered, but there were no human cases throughout the year.

At *Uitenhage* three human plague cases were reported (one fatal) in March 1904, but no further cases followed; and apparently there was no previous or subsequent infection of local rats.

NATAL.

A few sporadic plague cases were notified, numbering 17 in all, and 12 of them fatal, during 1904 in Natal. These were distributed throughout the year as shown below.

Plague in Natal.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Notified attacks	—	—	—	—	2	5	1	1	4	—	1	3	17
Reported deaths	—	—	—	—	1	4	1	1	2	—	1	2	12

Most of these cases were referred to Durban or its immediate vicinity. Plague among rats was discovered to exist from May to November in and around Durban. But the effect, if any, of rat plague on man appears to have been comparatively trivial.

MAURITIUS.

Plague seems to have become endemic in Mauritius, with tendency to epidemicity in alternate years; as appears from the table below which gives, year by year since 1898 to 1904 inclusive, the reported cases and deaths from plague in the island.

Year.	Plague.		Case mortality per cent.
	Attacks.	Deaths.	
1898	2	2	—
1899	1,416	1,117	78·9
1900	796	593	74·5
1901	1,093	805	73·6
1902	506	386	76·3
1903	1,394	1,034	74·2
1904	568	449	78·9
Total ...	5,775	4,386	75·5

Plague which was epidemic in Mauritius in the autumn and winter of 1903 continued into January and February, 1904. Though never entirely absent from the monthly returns the disease then remained dormant till August and September, when it began again to become epidemic and continued to prevail to the end of the year. The subjoined table gives month by month the number of reported cases and deaths from plague during the year.

Plague in Mauritius.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total for 1904.
Attacks ..	151	19	7	5	7	7	8	27	34	123	99	76	568
Deaths	115	15	6	5	6	7	8	18	25	113	76	55	419

From the Mauritius medical reports for the year January 11th, 1904 to January 9th, 1905,† it appears that the racial incidence was as follows :—

—	Mauritians.		Indians.*	Chinese.	Totals.
	White.	"Non-white."			
Cases ...	9	129	316	51	505
Deaths ...	5	92	247	36	380

These cases and deaths were distributed over the various districts of the Island as follows :—

Districts of Mauritius.	Plague.	
	Cases.	Deaths.
Port Louis	301	236
Pamplemousses	13	7
Rivière du Rempart	—	—
Flacq	22	17
Grand Port	28	23
Savanne	9	7
Plaines Wilhems	124	86
Black River	3	1
Moka	5	3
Total 12 months January 11, 1904, to January 9, 1905.	505	380

It is worthy of mention that no fewer than 220 cases—43·5 per cent. of the total attacks in Mauritius—were not discovered till after death from plague had occurred; and in addition other cases were found in a dying condition. These facts suggest that concealment of cases has had a share in the long continuance of plague in Mauritius. Rats and mice were examined bacteriologically for signs of plague, and in some instances they were found to be suffering from the disease.

During the year some 30,000 rats were destroyed in Port Louis alone.

A considerable amount of Yersin's anti-plague serum was used during 1904 in Mauritius, no fewer than 3,750 "bottles" having been sent from the Lister Institute in London; but it would appear that the results of its use were not encouraging.

No. 18.

PP. A, No. 18. Cholera throughout the World in 1904; by Dr. R. Bruce Low.

The MANIFESTATIONS of CHOLERA throughout the WORLD in 1904; by DR. R. BRUCE LOW.

INDIA.

There was considerable decrease in the amount of reported cholera in India during 1904 as compared with the previous year. The recorded cholera deaths in India during each of the last nine years are given in tabular form below :—

—	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Cholera—									
Deaths	488,070	569,276	152,711	171,410	822,282	283,634	224,135	314,311	193,657

The Presidency of Bengal sustained the largest amount of damage from the cholera epidemic of 1904, no fewer than 137,701 deaths of the 193,657 (above 70 per cent.) being referred to that province. Madras came next with 23,109 deaths, and Bombay with 13,156. Some provinces and states recorded no deaths from cholera during the year.

As regards 192,835* deaths from cholera reported in the year 1904 in the various provinces, excluding the Native States, the appended table shows month by month the number certified :—

Whole of India.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1901.
Cholera—													
Deaths ..	17,966	13,050	12,114	16,190	13,854	12,489	12,003	17,385	8,236	10,019	21,452	15 071	192,835*

BENGAL (1901 Census population, 74,423,193).

The 137,701 cholera deaths certified in the Presidency of Bengal in 1904 were fewer than in immediately antecedent years; in 1903 and 1902 they numbered 203,405 and 150,971 respectively. The district of Bengal which suffered relatively the most was Malda, where the ratio of deaths from cholera per 1,000 population was 4·70; the lowest rate was at Singhbhum where it was only ·09 per 1,000.

* For the Native States, regarding which trustworthy returns have been received, 822 further deaths have to be added, bringing the total cholera deaths in the Presidency up to 193,457.

The following table gives the incidence of cholera month by month during 1904 in the Bengal Presidency :—

Bengal.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
holera—													
Deaths ..	7,695	5,307	8,315	13,417	11,138	9,371	9,140	7,083	3,910	7,587	22,193	32,530	137,701

In the report of the Sanitary Commissioner for Bengal* for the year 1904 it is stated that cholera is nearly always more prevalent in river districts than in drier districts; with the explanation that everybody in river districts resorts to the river's bank for the purposes of nature. When the current in the river is slow and the volume of water small cholera is rife; when there is a good flood the disease is rare.

Comparatively few anti-cholera inoculations were performed in Bengal during the year. Formerly large numbers of coolies destined for the Assam labour districts were inoculated before being sent on. The Chief Commissioner for Assam has lately suggested the discontinuance of the anti-cholera inoculations, considering, it would seem, that the measure has not been of material effect in obviating cholera.

The disinfecting of wells in Bengal by permanganate of potash is regarded as having given encouraging results; when done thoroughly and regularly this has been of value, it is thought, in reducing the amount of cholera cases. It is proposed that native wells should be disinfected by this means as soon as the water is getting low, without waiting till cholera has actually made its appearance in a district.

Calcutta.—The reported deaths from cholera in this city during 1904 numbered 2,056, against 2,037 in 1903 and 2,716 in 1902. Cholera deaths in Calcutta during 1904 were distributed throughout the year as follows :—

Calcutta.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Cholera—													
Deaths ..	78	102	257	467	367	60	36	15	14	40	155	465	2,056

* By Captain W. Wesley Clemesha, M.D., I.M.S., Officiating Sanitary Commissioner for Bengal; Calcutta, 1905.

PP. A, No. 18. holera roughout ie World in 904; by Dr. R ruce Low.

BOMBAY PRESIDENCY (1901 Census population, 25,463,209).

During 1904 there was a large increase in the number of cholera deaths in the presidency as compared with two previous years, the deaths numbering 13,156 in 1904, against 1,825 in 1903 and 3,229 in 1902. The districts which suffered most in 1904 were Poona (3,105 deaths) and Sholapur (2,828), the respective rates per 1,000 of the population being 3·14 and 3·92. The incidence of cholera in the Presidency throughout the year is shown in the subjoined table :—

Bombay Presidency.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Cholera—													
Deaths ..	—	1	2	1	44	53	1,657	7,353	2,462	1,176	291	116	13,156

So far as can be learned the notified cholera attacks numbered 23,877, so that the case mortality was 55·10 per cent. The collectorate of Poona yielded 5,763 cases.

There was sudden increase of cholera during the month of July associated with Ashadi fair, which was attended, it is said, by about 300,000 persons. In Pandharpur town where the pilgrims assembled the disease appeared about July 21st. The fair closed on July 27th, and the pilgrims dispersed to their homes some of them carrying with them the germs of the disease. An explosive outbreak in August followed.

The *City of Bombay* recorded during 1904 some 290 cases and 219 deaths from cholera, 182 attacks and 134 deaths being referred to the month of August; the outbreak in this instance being undoubtedly connected with the return of pilgrims from Pandharpur.

MADRAS PRESIDENCY (1901 Census population, 42,397, 522).

Cholera in 1904 caused 23,109 deaths in the Presidency, as compared with 27,393 in 1903 and 29,769 in 1902. In this Presidency there has been a marked diminution in the cholera mortality in recent years, as is shown in the following table :—

Madras Presidency.	1896.	1897.	1898.	1899.	1900.	1901.	1902.	1903.	1904.
Cholera—									
Deaths	47,847	143,445	65,444	29,082	60,683	81,370	29,769	27,393	23,109

The districts of Madras which suffered the most from cholera in 1904 were Tanjore (6,189 deaths) and South Arcot (4,866). In these districts many of the village water supplies, taken from irrigation channels, are open to excremental pollution in passing groups of dwellings.

The following table shows month by month the number of deaths reported from cholera during 1904 in the Madras Presidency :—

Madras Presidency.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Cholera—													
Deaths ..	9,803	7,426	3,208	1,148	678	247	180	170	49	33	07	100	23,109

In the city of Madras, with a population of 509,346, there were not more than 60 deaths from cholera recorded during the year, 34 of which were referred to the month of March.

United Provinces of Agra and Oudh (1901 Census population, 47,691,782).

The total deaths from cholera in the United Provinces during 1904 was 6,617, compared with 47,159 in the preceding year. The rate per 1,000 of the population was ·14 in 1904, against ·93 the average of the previous five years. The distribution of these cholera deaths throughout the months of 1904 is shown in the statement below :—

United Provinces.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Cholera—													
Deaths ..	81	67	109	803	1,400	1,989	416	262	440	518	376	156	6,617

The greatest incidence was in the districts of Gonda (Fyzabad Division) and Basti (Gorakhpur Division) with 2,022 and 1,510 cholera deaths respectively, with rates of 1·44 and ·82 per 1,000 of the population.

The Punjaub (1901 Census population, 24,754,737).

There was no severe prevalence of cholera in the Punjaub during 1904, only 716 deaths being certified from the disease. Of these 228 or nearly a third were referred to the district of Hissar, where the water supply of a certain village became contaminated, thus causing a localised epidemic.

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ASSAM (1901 Census population,* 6,126,343).

Compared with the last three years there was a considerable diminution in 1904 in the amount of cholera in Assam, only 5,588 deaths from the disease being recorded. In 1902 and 1903 cholera deaths numbered 12,658 and 8,360 respectively. The cholera deaths month by month in Assam in 1904 are given in the subjoined table :—

Assam.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Cholera—													
Deaths ..	149	69	139	351	327	389	219	148	149	307	1,285	2,026	5,568

The ratio of cholera deaths per 1,000 of the population was 1·08 compared with 2·30 the ratio of the five previous years.

The greatest incidence of the disease was in the Sylhet district, in the Surma Valley, where 3,683 cholera deaths were recorded during 1904.

BURMA (1901 Census population, 10,490,624).

Lower Burma.—During 1904 there came under observation 3,369 cases of cholera in Lower Burma, and of these 2,472 proved fatal—a case mortality of 88 per cent.; in 1903 the cases numbered 8,532 and the deaths 5,346—a fatality of 63 per cent. In 1904 the disease is reported to have invaded 21 towns and 607 villages, but the number of cases occurring in each locality was comparatively small.

In *Upper Burma* 508 persons are reported to have died from cholera during 1904, compared with 2,887 in 1903. One small outbreak of illness in 1904 assumed to be cholera, turned out on investigation to be due to ptomaine poisoning from eating the decomposing flesh of a bullock, and the civil surgeon who made the investigation expressed the opinion that other small outbreaks of reported cholera in rural districts may probably have had similar origin.

The appended table gives month by month the number of reported cholera deaths during 1904 in Lower and Upper Burma :—

Cholera Deaths.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total in 1904.
Lower Burma	166	96	286	474	148	120	108	208	219	272	240	140	2,472
Upper Burma	70	84	4	—	17	24	88	204	11	3	—	3	508

* The registration districts of the Surma and Brahamaputra Valleys have a total population of 5,275,706, and these figures are used in the statistical calculations by the Sanitary Commissioner.

Other Indian Provinces and States.

Only 150 cholera deaths were certified in *Central India* during 1904, against 1,110 in the preceding year.

In the *Mysore State* 471 cholera deaths were reported. In *Rajputana* and in the *North West Frontier Province* only a single case was in each instance reported.

French "Establishments"* in India
(1901 Census population, 273,185).

The total number of deaths which were reported in the French "establishments" in India from cholera during 1904 was 731, as compared with 435† in 1903. The place which suffered most from the disease was *Karikal*, situated in the Canvery delta on the Coromandel coast, with a population of 56,595, among whom 220 cholera deaths were recorded.

CEYLON.

Colombo.—Several shipborne cases of cholera were reported from Colombo during 1904. On March 1st the English s.s. *Clan Stuart* from Calcutta arrived at Colombo and reported that three days before arrival a stoker had died from an illness the nature of which the master had not recognised. Another stoker who had waited upon the first case was attacked by the same sort of illness and was landed on March 2nd at Colombo for treatment in the port hospital.

On November 3rd the English s.s. *Torridge* arrived at Colombo from Bassein (Burma) with three of her crew suffering from cholera, one of whom died before removal to hospital. The other two patients were landed at the port hospital, and on the following day three more cases were discovered on board and taken on shore for treatment. Of the six cases, four proved fatal, viz., one on board ship and three at the hospital. The disease in this instance proved to be cholera.

FRENCH INDO-CHINA.

Cochin China (Population, 2,960,000). — Cholera appears annually in this French colony and in 1904 was reported from a number of different localities, the most severely affected being Mytho and Chandoc. The total number of cholera attacks and deaths is not known; the number of the latter which came under official observation was 675, but it is held that these figures are far below the reality. In the province of Gocong alone 430 deaths were reported. The port of Saigon was attacked in July; the disease it is said having been brought from the interior.

Tonkin (population, 9,000,000).—In this colony certain localities were invaded by cholera during 1904, but there occurred con-

* These comprise Pondicherry, Karikal, Chandernagore, Yanaon, and Mahé.
† The number of cholera deaths, 435, for 1903, is taken from a recent official report by Dr. Kermorgant, published in the Bulletin de l'Académie de Médicine No. 13, 1906. The number of deaths given in the annual report for 1903, 253, was therefore incorrect.

[illegible] siderably fewer deaths than in the previous year. During April and May the province of *Thai-Binh* was attacked. In the town of that name 181 deaths were officially certified. In Phu de Tien-Hung during the month of April 182 persons were known to have suffered from cholera, and of these 46 died.

Other places were invaded, such as Thanh-Hoa, Phu-Ly, Ninh-Binh, and Hanoi. But no details of these latter outbreaks have been forthcoming.

Laos population 800,000.—It is known that cholera appeared in 1904 in the province of Bassambong in the Colony of Laos. But no details have as yet been officially published respecting this outbreak.

STRAITS SETTLEMENTS.

Singapore.—In 1904 three fatal cases of cholera were notified in Singapore, against 226 cases and 190 deaths in 1903. From the British Consular reports it appears that with the exception of the above three cases no cholera attacks came under observation.

Penang.—Five imported cholera cases occurred at Penang during 1904; they were removed at once to the quarantine station on Pulau Jerejak.

BORNEO.

In August, 1904, cholera is stated to have appeared at Kudat (or Koudet), the capital of the Saba territory, a seaport situated at the north-eastern corner of British Borneo. No details of the outbreak, however, have been received.

LABUAN.

Cholera appeared in December, 1904, in the Island of Labuan, which lies near the north-west coast of Borneo. No report has yet been forthcoming as to this outbreak.

DUTCH EAST INDIES.

Island of Celebes.—An official communication* dated December 20th, 1904, stated that cholera was prevailing epidemically in the territorial district of Bouthain and also in the port of Boeloe-koemba (or Boulukumba), which places had accordingly been declared infected by cholera. Later reports show that the epidemic continued during the early months of 1905.

THE PHILIPPINES.

It has been recorded that a severe epidemic of cholera swept over the Philippine Islands during 1902. This continued, though in less amount, in 1903, finally disappearing in the spring of 1904. The total cholera cases and deaths recorded during 1904, January to May, numbered respectively 127 and 85. It is stated that from March 20th, 1902, to May, 1904, there occurred in the Philippine

[illegible] Cholera throughout the World in 1904; by Dr. R. Brass Low.

* *Vide* Bulletin Quarantenaire d'Egypt, January 12th, 1905.

Islands 160,671 attacks and 105,075 deaths; 5,581 attacks and 4,386 deaths were referred to the town of Manila. In 1904 from May to the end of the year no further cases of cholera were reported in the Philippines.

CHINA.

Hong Kong.—Cholera in Hong Kong during 1904 comprised 41 cases and 35 deaths. This outbreak, which was confined to the Wanchai district, occurred during the months of May, June, and July. The persons chiefly attacked were coal coolies engaged in loading ships. In two instances only the infection was shipborne, from Saigon (Cochin China).

Shanghai.—Cholera was reported as prevailing in Shanghai in August, 1904, scattered cases having been observed in July. No official figures as to the incidence of the disease in the native population are, however, available. Locally spread of cholera is thought to be facilitated during the season when melons are ripe. Melons it appears cut into small portions and exposed for sale on the stalls in the native quarters are apt to become covered with swarms of flies, and, as these cut melons are a favourite food of the coolie class, it is believed that infection conveyed by flies from fæcal matter has thus been operative in causing cholera. Dr. Stanley, the European Medical Officer of Health, made in this connection some experiments as to the viability of the cholera organism when planted on certain fruits, and he found that on watermelons the cholera vibrio grows luxuriantly for a considerable time, until indeed the fruit putrefies.

A few cases of cholera were reported in 1904 from *Amoy* and *Antung*, but definite details have not been forthcoming as to these occurrences.

JAPAN.

Although there were no cholera outbreaks reported in Japan during 1904, there were a few imported shipborne cases at certain of the ports; some of which attacks were doubtfully cholera. Two such cases, both fatal, occurred at Yokohama—one at Kobe and one (on board a French sailing vessel) at Hakodate. A single fatal imported case also occurred in June at Tamsui in Formosa.

ENGLAND.

No cholera cases occurred in England and Wales during 1904. But three ships arrived, technically infected, at our ports having had one or more cholera cases on board during the voyage or antecedently at the port of departure. These instances were as follows:—

(1) s.s. *Warwickshire* from Rangoon arrived at the mouth of the Thames on January 10th, having touched at Colombo, Suez, and Marseilles. The master reported that on December 6th, 1903, three days before the ship sailed from Rangoon, a fireman on board was attacked by a cholera-like illness and was landed at the port hospital; the vessel was then disinfected and sailed on

December 9th for Colombo. During the voyage a few cases of diarrhœa, apparently not of a severe kind, occurred. There was no confirmation bacterioscopically of the diagnosis of cholera in this instance. All on board, viz., 12 officers and 163 crew (95 of whom were non-Europeans) were found in good health when medically inspected on arrival at the mouth of the Thames.

(2) s.s. *Clan Stuart* left Calcutta on February 24th and arrived at Colombo on March 1st. Two days after her departure from Calcutta a stoker had been seized with sudden illness, suspiciously resembling cholera, of which he died next morning and was buried at sea. On March 2nd, while the vessel was lying in the harbour at Colombo, another stoker fell ill and his ailment was diagnosed as cholera, for which he was landed at the port hospital. The ship after being disinfected resumed her voyage, arriving at Suez on March 15th, where she was again disinfected before passing through the canal. After touching at Malta the *Clan Stuart* arrived at the mouth of the Thames where, on medical inspection, all on board were found to be well.

(3) s.s. *Arabistan* left Bassorah on May 13th, where she had been lying since May 2nd, touching at Bushire on May 14th and arriving at Karachi May 19th where she remained till May 25th. She called at Djeddah on June 5th, Suez on June 10th, and reached Hull on June 27th; finally she arrived at the mouth of the Thames on July 1st. The master reported that on May 13th, the day the ship sailed from Bassorah, a native fireman was attacked by cholera and died next day. The ship and the crew's effects were disinfected at Karachi, and at Suez. On arrival in this country all on board were well.

EGYPT.

There were no indigenous cases of cholera reported in Egypt during 1904; but two cases occurring on board a British vessel were dealt with at Suez. Both cases proved fatal, and the diagnosis was confirmed by bacterioscopic investigation.

The vessel in question, the s.s. *Coulsdon* outward bound from Manila, Soerabaya, Panna, and Samarang, left the last-named port on September 26th for Delaware. On October 5th a Chinese stoker developed symptoms of cholera, of which he quickly died. On the vessel's arrival at Suez on November 4th, two other Chinese stokers were found to be suffering from choleraic symptoms, of which after they had been landed at Moses Wells Sanitary Station, one died the same day and the other three days later.

The *Coulsdon* was disinfected and all necessary precautionary measures were taken, after which the vessel resumed her voyage, passing through the canal "in quarantine." There were no subsequent developments of disease on board the ship of a choleraic kind.

TURKEY.

It has been recorded that at the end of 1903 cholera was still lingering in certain districts of Syria and Mesopotamia,

especially about Aleppo, Latakia, Hauran, Diabekir, Hindieh, Mossul, Musseïeb, Bagdad, and Kerbela. From these localities in Mesopotamia cholera spread in the early part of 1904 to neighbouring districts. After a brief period in which the disease seemed to subside, cholera began in the early summer months to assume greater virulence and gradually became somewhat widely diffused throughout Lower Mesopotamia. Among the places which suffered most severely may be mentioned Bagdad, where some 1,500 persons were attacked, of whom upwards of 1,100 died. About this time a death from cholera occurred on board the British gunboat *Comet*, which was then lying in the River Tigris off Bagdad. At Solimanieh it is estimated that more than 1,000 persons perished during the cholera epidemic in that town. Other places implicated in the epidemic were Djemat, Hilla, Kerbela, Mendeli, and Nedjeff.

Travelling southwards through Bassorah the infection reached the Arabian shores of the Persian Gulf. The Bahrein Islands, situated off the east coast of Arabia, were invaded, the outbreak proving extremely severe, no fewer than 1,500 victims perishing from the disease within a period of four weeks. The infection next spread along the coast to Koweit, Katar, and Muscat, and thence, following the ordinary caravan routes, cholera penetrated into the interior, where a number of oases were invaded.

At the end of 1904 cholera was still present in Mesopotamia. So far as can be learned from Turkish reports, there occurred during 1904 in the Ottoman Empire 10,466 cases, 9,192 of which ended fatally. It is probable, however, that these figures do not represent the full extent of the cholera epidemic in Asiatic Turkey.

It is worthy of note that the Holy Pilgrimage of 1904 to Mecca passed off without the appearance of cholera in the Hedjaz, notwithstanding the presence of the disease in Mesopotamia, from which region pilgrims would no doubt be attending this religious festival. It is stated that no fewer than 200,000 persons were assembled together on Mount Arafat, not far from Mecca, at the culminating ceremonies of the Haj at the end of February. It speaks well, therefore, for the precautionary measures carried out with respect to the pilgrims that no developments of cholera occurred in the Mohammedan Holy Land during or after the pilgrimage of 1904.

PERSIA.

Cholera spread from Mesopotamia, in the spring of 1904, into Persia, the disease being conveyed by Shiah pilgrims returning from the holy burying grounds of Kerbela, or Meshed-Hossein, which lie 28 miles north-west of Babylon. Northwards the disease was carried to Kermanshah, and after ravaging that city spread in many directions throughout Persia. It is alleged that the towns along the eastern side of the Persian Gulf were infected directly from Bassorah, not from Kerbela. But be this as it may cholera became epidemic throughout Persia, where the grossly insanitary state of the towns and villages and the generally polluted state of the water supplies greatly assisted

the spread of the disease. Statistics are at all times difficult to obtain from Persia, and are seldom trustworthy. Consequently it is not easy to give account of the number of cases and deaths which have been comprised in this epidemic. Various approximations have been put forward, some authorities estimating the total cholera deaths in Persia during 1904 at 70,000, while others reckon that from 250,000 to 300,000 persons lost their lives during the epidemic. The British delegate on the Ottoman Board of Health at Constantinople furnishes the following estimate of the number of cholera deaths which occurred from cholera at the undermentioned places in Persia in 1904 :—

Provinces.	Approximate Number of Cholera Deaths.
Kermanshah	13,000
Hamadan	15,000
Arak	10,000
Malayer Tousserkan	7,000
Koum	10,000
Tehran	26,000
Kasvin	8,000
Ghilan	14,000
Mazanderan	12,000
Khorassan	13,000
Ispahan	16,000
Shiraz	30,000
Arabistan	22,000
Azerbaijan	30,000
Kerman	16,000
Other Provinces	30,000
Total	272,000

RUSSIA.

In the summer of 1904 cholera was carried across the Russian frontier into Transcaspasia by fugitives from Meshed and other infected towns and villages in the north-east of Persia.

The first Russian place to be invaded was the border town of Kaakhi where in three days some 57 soldiers of the garrison were attacked; and among the victims who perished from the disease was the surgeon in charge of the troops. From Kaakhi the infection was carried by Cossacks to Merv, where in a short time some 66 cases were reported of which 53 belonged to the garrison. From Merv cholera travelled westwards, during August, towards the Caspian sea, following the line of the railway from Merv to Krasnovodsk, the port from which steamers cross the Caspian Sea to Baku. Among the places invaded by cholera in Transcaspian Territory may be mentioned Askabad, Tejend, Serakh, Hasankuli, and Bairam-Ali. Notwithstanding stringent precautions adopted by the Russian authorities cholera was carried westwards across the Caspian to Baku, and northwards to the mouth of the Volga, on board the lake steamers, by Persian passengers towards the end of August. A considerable epidemic developed at Baku and spread to the adjoining towns and districts comprised in the Government of Baku, including Dshewat, Lenkoran, and Balachany. Precise details as to the number of cases and deaths which occurred in this Government have been difficult to obtain, but it appears that at least 2,000 persons were attacked and that 1,600 died between September and December, 1904. This estimate is in all probability far below the truth.

From Baku cholera spread westwards to towns and Government districts along the railway line from Baku to Batoum. The Government of Erivan suffered severely, especially the town and district of Erivan, and the districts of Schauro-Daralages, Nachitschewan, Etschmiadsin, Nowabajazet, Alexandropol, and Surmalin. No definite details of the behaviour of cholera in the Government of Erivan have been available, but with the fragmentary reports derived from different sources it seems certain that more than 5,000 persons were attacked by cholera in this Government during the last four months of 1904, and that more than 3,500 perished from the disease.

In the Government of Elisabethpol, the districts of Dshebrail, Sangesur, and Elisabethpol were invaded, but it has not been found possible to make any estimate of the number of attacks and fatal cases that occurred in this portion of Transcaucasia. The town of Tiflis was also infected by cholera in November through railway passengers coming from Baku and Erivan.

Finally cholera reached the Black Sea port of Batoum in December, but the number of cases there was small. So far as the westward progress of cholera by way of Transcaucasia to Europe was concerned, the infection seemed to have exhausted itself, for there was no further extension of the disease beyond Batoum into Europe.

As has been said cholera was carried from the eastern shore of the Caspian Sea by lake steamers to the mouth of the Volga. It then ascended that river invading, during September, towns and districts in the provinces situated on its banks. The provinces

which chiefly suffered were Astrachan, Saratov, and Samara. Higher up the river other towns and villages were also attacked yielding small groups of cases, or single instances. The disease was carried by river craft high up the Volga as far as Nijni Novgorod and Yaroslav, the latter town being situated about 160 miles north-east of Moscow. In November cholera was reported to have reached Ufa, situated on a tributary of the Volga to the extreme east of European Russia; the infection in this instance having been conveyed from Samara by prisoners proceeding eastwards. The sanitary condition of the towns situated on the Volga is notoriously bad, and this doubtless contributed to the spread of the disease and the difficulty of getting control of it.

Definite details of these outbreaks of cholera in the Volga provinces have not been obtainable. The official reports which have been issued are of extremely meagre description.

At the end of 1904 the Russian Government officially declared the following regions to be "threatened by cholera":—the shores of the Caspian Sea; the Governments of Astrachan, Saratov, Sambirsk, Kazan, and Nijni Novgorod; the provinces of Transcaspasia, Samarkand, Ferghana, and Syr-Daria; the Russian settlements in the suzerainties of Bokhara and Khiva; the Uralsk Province; the Don Territory; and the Governments of Perm, Ufa, Stavropol, Orenburg, Viatka, Tiflis, Elizabethpol, and Baku.

The Governments of Yaroslav, Kostroma, Vladimir, and Tver, all on the Upper Volga, were added to the list early in 1905; and those of Moscow, Tambof, and Riazar, though not declared to be threatened, were ordered to prepare for a possible epidemic by opening observation stations along the river.

The fears of the Russian Government, it may be added, were realised. Cholera broke out in Volhynia and Poland in the summer and autumn of 1905. How the disease passed across Russia from the Volga to the Vistula is not clear.

In passing from Central Asia during 1904 across the Caspian Sea and up the Volga to Western Europe, cholera followed a route which previous experience has shown to be one dangerous to the whole of Europe. The appearance of cholera in Europe during 1905 will be dealt with in a subsequent report.

APPENDIX B.

No. 1.

FURTHER REPORT on the TRANSMISSION of PLAGUE in the RAT; by DR. KLEIN, F.R.S.

The methods by which plague can be transmitted, whether to man or to the rat, have long been the subject of much discussion, observation, and experiment; so that our knowledge in these matters is by no means restricted in character. Nevertheless some observers seem to regard the chief method of transmission of plague as likely to be parallel with that observed in regard of diseases like malaria and yellow fever.

Malaria is accepted as solely transmitted by the bite of an anopheles mosquito, and a like method of transmission is probably true for yellow fever. But in malaria the anopheles having sucked, along with blood from a human being, the malarial parasite in a certain phase of this parasite's life, becomes the host of such parasite in further phases of its development; until, that is, the parasite is ripe again for infection of the human subject by means of the bite of the mosquito which has harboured it. There is no other way of transmission of malaria at present proved.

As an agent in the transmission of plague, the flea has been indicted by Ogata, Simmonds, Tideswell, Ashburton Thomson, and others; while Hankin has quite recently gone a step further, considering the flea a real intermediary host of plague in much the same fashion as the mosquito is host to malaria.

As to this latter hypothesis, that of an intermediary insect host of plague, a number of considerations deserve notice which militate greatly against its acceptance even provisionally. But with reference to the flea as a mere agent in spread of plague, Captain Liston in a paper read before the Bombay Natural History Society, as reported in the "Lancet" of February 25th, 1905, is inclined to attribute to the flea proper to a particular species of rat an important rôle not only in the transmission of plague from rats to other animals, but also from the rat to the human subject. Captain Liston's suggestion that plague is not readily transmitted from the brown or sewer rat (*mus decumanus*) to man is quite in accord with my own view as to the lesser susceptibility of this species to plague. It harmonises also with the results of my own observations (as described in my reports for 1902–1903 and 1903–1904) as to the lesser virulence of B. pestis, type 2, or the "Rat type," and the probably greater virulence of B. pestis of *mus rattus*, which living as it does more in relation with human dwellings is therefore more likely than *mus decumanus* to be subject to the extra virulent or "human type" of B. pestis. As to Captain Liston's view that plague is commonly transmitted from *mus rattus* to man by means of the flea proper to that species of rat, more evidence is wanting. Transmission of plague

in this way though theoretically quite possible does not seem to me to have a basis of direct experiment as regards the species of rat and flea in question.

Plague has been experimentally proved to be transmissible in a number of ways, which under natural conditions must needs frequently find their counterpart. Thus, no one doubts that just as in the laboratory cutaneous inoculation of the B. pestis is an infallible means of producing plague in the rat, so also under natural conditions an abrasion of the skin of this animal may serve to give entrance to B. pestis. Similarly, numerous cases of plague in human beings who, having some broken skin on the hand have handled plague materials and developed axillary plague bubos on the injured side, as also others who in a similar fashion have contracted femoral plague bubo of one side owing to a cutaneous injury on the foot of that side, are in no want of explanation. Again, rats in their wild state are rarely without some objective sign of their fighting habits; wounds on tail or snout for instance. Application of B. pestis, present in infected food, filth, or other substances, to such wounds on tail or snout would, no doubt, often result in plague of the animal thus, as it were, inoculated. Further, no one doubts that the expectoration of a case of pneumonic plague is charged with B. pestis, or that such expectoration is highly infectious if it finds entrance into a healthy person, as for instance along with microscopic droplets of mucus coughed out into the atmosphere by the affected patient. In a word, no one doubts that so long as the B. pestis is present and virulent in quality, its direct access to the tissues of a susceptible human being or of a rat could, and often would, cause the disease. Obviously, therefore, it is unnecessary for the successful transmission of plague to man or to rat, that B. pestis should have previously been taken up by, not to mention stored within, an intermediary host like the flea.

The essential point about the transmission of the disease is, as I have said, that the B. pestis *per se* of a plague case (man or rat) should obtain entrance into a new individual. B. pestis of the laboratory has no particular phases in which only it is specially active; in no sense, therefore, is it parallel with the malaria parasite in this respect. Active B. pestis has practically but a single phase, namely, that of a bacillus multiplying by fission. This bacillus, whether taken from an active animal source or from an actively growing culture is always, so long as its normal virulence has not deteriorated, effective on inoculation.

In last year's report I pointed out that as regards a large percentage of rats dying quickly of virulent plague, the blood of the circulation just before death contains the B. pestis sometimes in great numbers, as is shown both by microscopic examination and by culture experiment. It is, therefore, quite possible that fleas fed on the blood of an animal dying in this state might contain the B. pestis. Also I pointed out that in the virulent or "human" type of plague in the rat, the bacilli are more copiously present in the blood of this animal than in the less virulent or "rat" type. Wherefore fleas fed on the blood of a rat affected with the first type of B. pestis would be more likely to contain

B. pestis than if fed on the second or "rat" type, and the more competent therefore by hypothesis to cutaneously inoculate other rats in proceeding at once to bite them.

Subject to these reservations, the possibility of transmission of plague from rat to rat by means of fleas cannot be on theoretical grounds denied. But the question to which answer is wanted is the extent to which this method of transmission is common, as compared with the more obvious methods previously mentioned in reference to this animal, viz., by cutaneous abrasions or wounds coming in contact with plague-infected matter, by ingestion, or by way of the respiratory tract. In order to assign to these different modes of transmission their proper rôle it is necessary to bear well in mind: (1) the distribution of B. pestis in an infected animal (rat), and (2), the experimental evidence at present to hand in regard to production of plague in the rat by one or another method.

In a rat acutely affected with the virulent or human type of plague B. pestis is distributed throughout the body. If an animal has been cutaneously inoculated the nearest lymph glands are crowded with B. pestis; the blood of the general circulation contains the bacillus in great number; the spleen is crowded, sometimes literally packed with them; and in the blood vessels of the liver, the lungs, and the kidneys B. pestis is abundant.

In more than fifty per cent. of the animals of last year's experiments the *small intestine* was found relaxed and much congested; and its cavity contained blood-tinged mucus, which under the microscope showed along with blood corpuscles numerous bipolar stained bacilli. Guineapigs injected subcutaneously with this mucus, and rats inoculated with it cutaneously, develop in the great majority of instances definite plague. Whenever, in fact, a rat dies of plague and shows the above condition of the small intestine, viz., congestion of the wall and blood within the cavity, the probabilities are that this sanguineous mucus contains also the B. pestis derived from ruptured vessels; and certainly I have had no difficulty in producing plague in rats or guinea-pigs injected subcutaneously or inoculated cutaneously with such sanguineous mucus. As regards rats therefore suffering acute (septicæmic) plague and the subjects consequently of hæmorrhage into the intestines, it is reasonable to anticipate that their bowel discharges will contain B. pestis; that this is so is indeed clearly indicated by experimental evidence.*

The *kidney* is another organ which in acute virulent plague of the rat shows not only great congestion (the vessels of all parts being filled with and even distended by blood), but exhibits also actual capillary hæmorrhage, particularly amongst the convoluted tubes of the cortex and in the Malpighian tufts. I have on careful examination of microscopic sections of the plague-kidney of the rat noticed B. pestis not only in the distended capillaries of the

* This I maintain notwithstanding that Mr. Hankin in an article in the "Journal of Hygiene," Vol. V, No. 1, appears to discard this mode of transmission, viz., by the bowel discharges of a plague rat. (But as to this *see* positive experiments which follow).

glomeruli and between the uriniferous tubules, but I have seen them, and have described them in last year's report, as occurring in the cavity of the Malpighian capsule and in uriniferous tubules themselves. It follows, therefore, that occurrence of B. pestis in the urine of such animals is to be confidently expected; indeed, in several animals (rats and guinea-pigs) dead of (inoculated) acute virulent plague the urine of the bladder was found by me distinctly tinged with blood; and such urine on injection into other rats and guinea-pigs produced typical plague. Two instances during this year's experiments will be sufficient to further prove this: (*a*) A rat was inoculated on 26th April with virulent agar culture of B. pestis. The animal was dead on 29th of the month with acute typical plague. The bladder was found distended by blood-tinged urine. With this urine one rat and one guinea-pig were injected subcutaneously; both animals died of plague with copious presence of B. pestis in the bubo and spleen. (*b*) A guinea-pig was injected subcutaneously with recent agar culture of B. pestis on 18th February. It was dead on the 22nd of the month with typical plague. The bladder was distended with urine. A guinea-pig was injected subcutaneously with this urine on the same day. The animal was found dead with typical subacute plague on March 1st, the bubo, spleen, liver and lungs containing in the neerotic nodules crowds of B. pestis. Blood must, therefore, have found its way into the cavity of the bladder in these cases and with it presumably B. pestis. Hence the urine of a rat affected with the acute virulent (septicæmic) type of plague has to be regarded as very possibly infective.

The *lung* of the plague rat is always more or less congested, occasionally showing minute capillary haemorrhages. Sections show in some lobules effusion of blood, and in films thereof B. pestis is detected. But I have not been able to satisfy myself that the mucus of the mouth, pharynx, or larynx of the rat dead of acute plague commonly contains B. pestis; several experiments made in this direction have not been productive of positive results, the mucus having been taken carefully without injuring the blood vessels of the mucus membranes.

The lung appearances are, however, altogether different in rats which do not succumb with acute plague, but which pass on into the subacute or even chronic stage; rats, that is, which, though affected with plague, do not succumb within five or six days. In former reports I have pointed out that under these conditions the lungs are profoundly and intensively affected; that they show extensive consolidation, the bronchi being filled with inflammatory products containing crowds of plague bacilli*; and I have described experiments showing that the oral, pharyngeal and laryngeal purulent exudation of a rat so affected produces on cutaneous inoculation typical acute plague.† From this it was inferred by me that a rat of this kind would by its bite of another rat be capable of communicating plague (by cutaneous inoculation) to such other rat. A chronically affected rat would, I noted, have

* *See* Plate in Report of the Medical Officer for 1901-1902.

† l.c., *see* Fig. 9, Plate III., p. 690. Report of Medical Officer for 1902–1903.

many chances of doing this, seeing that such rat is generally drowsy and sulky, and that when disturbed by other animals it generally bites them, a method of positive inoculation actually observed under experimental conditions.

[It may be added that the German Plague Commission have produced plague in rats by simply placing plague material into their conjunctival sacs; and further, it has been observed that rubbing in plague material (taken from a plague animal or from culture) into the skin of the nostrils or mucous membrane of the nasal cavity of guinea-pigs was sufficient, in a majority of instances, to produce plague.]

Ways and opportunities of experimentally infecting rats with plague with materials derived from plague rats are in fact so many and various that it is probable that abundant opportunity of rat infecting rat can occur also under natural conditions; so that the transmission of plague by fleas from the affected to the healthy rat would at best but represent but one among numerous ways, one moreover that would require more conditions for fulfilment than many others. The chances, for instance, that the bowel discharges, the kidney secretions, or the secretions of the diseased lung of a plague rat would find contact with an abrasion of the skin of the body, or even with the skin and mucous membrane of nose and mouth of healthy rats are obviously greater than that a flea from an infected rat retaining B. pestis after biting the plague rat would settle on a fresh rat and communicate the disease to it by its bite. I do not mean to doubt this latter possibility,—in fact, as I have already said, I consider this theoretically quite possible—all I would urge at present is: that the chances that it actually occurs, and as some would have it frequently occurs, are far fewer than those other chances mentioned above, viz., those that might almost be called ever present during prevalence of plague among rats. Dr. Tideswell's positive experiment, on which I have commented in a former report, appears to me not cogent as to the transmission of plague from rat to rat by the bite of the flea, and so far numerous observations as to the presence of the true B. pestis in fleas taken from rats affected with plague (including the later experiments by Simmonds) have yielded negative results (see the Report of the Bombay Plague Laboratory for 1903).

Hankin (Journal of Hygiene, Vol. V., No. 1) describes a single observation as to a flea which contained in its stomach B. pestis, as shown by microscopic examination and by culture. This, however, proves no more than that a flea taken from a plague rat may contain the B. pestis; it is far from justifying the proposition that such a condition indicates one of the general modes of the transmision of plague, and affords no warrant at all for supposing that the flea represents a real intermediary host in which the B. pestis multiplies and acquires virulence. Nevertheless, Hankin attempts to explain in the latter way certain epidemics of plague in man which have appeared in particular localities some considerable time after the introduction of a case of plague into them.

So far I have left out of consideration one possible channel of transmission of plague to rats which must be, and has always been, in the mind of everyone acquainted with plague as it occurs in nature. This is transmission of infection by means of food, *i.e.*, infection by way of the alimentary canal.

First of all, what are the epidemiological facts observed hitherto? It is an occurrence of no uncommon kind for rats to die of plague in places where fodder and food-stuffs are accessible to them, *e.g.*, fodder, grain, rice and flour stores, larders on ships, &c.; and in circumstances consistent with such rats having contracted the disease by eating food-stuffs previously specifically contaminated by plague rats. For instance, a plague rat living in stores would most probably be capable of polluting these foods-stuffs by its intestinal discharges, by its urine, possibly also after death by dispersal of plague bacilli previously stored in its tissues.

In the second place there is no theoretical reason why both in the rat, as also in the human subject, the mucous membrane of the digestive tract, including that of the mouth and fauces, should not be as amenable (perhaps more so) to the entrance of the B. pestis as is the corium of the skin. In the mucous membrane there is no protective dry cuticle to be overcome as in the skin; seemingly, therefore, B. pestis has only to be lodged in the soft surface epithelium—which, under the many mechanical operations involved in the process of mastication, deglutition and digestion, might occur—in order to become actually "inoculated." The introduction with positive result by the German Commission of B. pestis into the conjunctival sac of rats would be an illustration in point; and here the mechanical action of the eyelids would be capable of ensuring such "inoculation."

It is matter of history, however, that numerous experiments made in the laboratory in feeding rats and other susceptible animals with plague cultures, and with fresh organs of animals dead of plague, have commonly failed. Leaving out those positive instances* in which cervical bubos and plague occurred in a rodent (guinea-pig, rat, mouse) after gnawing the bones as well as the viscera of a plague animal; positive instances which might have been really due to inoculation of an abrasion caused by sharp points of bone splinters; negative results have hitherto

* In the large number of experiments of feeding made by the German Plague Commission, there were only very few cases indeed in which a direct infection viâ the intestine could, from the anatomical lesions found on post mortem, be considered to have actually occurred—leaving out those instances in which infection had clearly taken place viâ the fauces—and in the positive instances (second type of the Commissioners) the intestinal infection appears to have occurred in rats only after feeding them with other rats dead of plague.

The Austrian Plague Commission, in their feeding experiments, seem to have had positive cases of septicaemic plague in guinea-pigs and rats, but of a character which clearly denoted infection to have taken place from the mouth or fauces; but they appear to have had some fair positive intestinal infections (Peyer's patches hæmorrhagically infiltrated or necrotic, and the same condition of the mesenteric glands) in guinea-pigs only, after feeding them on animals dead of plague. But most of their feeding experiments (on rats and mice) were negative *quâ* intestinal infection; positive infection clearly occurred from the mouth or fauces.

been in the main recorded. I know from a personal communication made to me by Professor Haffkine, that at the Bombay plague laboratory attempts at producing plague in rats by feeding have been uniformly unsuccessful.

I myself have to record a considerable number of failures of the same kind. Guinea-pigs, rats, and mice were repeatedly fed by me with milk culture and with broth culture of B. pestis, as also with fresh organs (bubo, spleen, liver, lung) of animals dead of typical plague. But without result; the animals remained unaffected. After a fortnight or so they were subjected to inoculation with active B. pestis in an abrasion of the skin, in a puncture of the oral mucous membrane, or by rubbing the material well into puncture of the skin of the nostrils; and in all cases acute plague was the result. Only once out of 20 experiments on sewer rats have I had positive result by feeding. This rat had been fed (at the same time as others) with plague organs of a rat dead of inoculated plague; and it too died of plague. The intestine showed general congestion, and the mesenteric glands were enlarged and much congested. But I did not consider this a proof that the animal had become infected by way of the intestine, because such a condition occurs also not unfrequently after subcutaneous or cutaneous inoculation; and, further, because in the above rat the lungs and bronchial glands were in the same condition as the intestine and mesenteric glands. Be this, however, as it may, it occurred to me that the probable reason why simple feeding with plague organs or with active culture of B. pestis is rarely followed by infection, is that the B. pestis is commonly destroyed by the secretion of the stomach during digestion. I suspected that if B. pestis could reach the small intestine unscathed—*i.e.*, in a living state—its power of multiplication would not only not be interfered with, but that the alkaline condition there might help it. A good parallel illustration is to hand in the case of the bacillus of fowl cholera, viz., a microbe which manifests its activities in the small intestine of that bird, this being the organ principally affected by the disease. It is extremely difficult to produce in the laboratory a positive result by feeding fowls or rabbits—both highly susceptible to inoculation—with culture of the bacillus of fowl cholera. Nevertheless, it is notorious that when once the disease is introduced into a poultry farm it rapidly spreads, and that it probably does so by means of matter escaping from the alimentary canal of the fowls; the droppings of a diseased fowl teeming with the specific microbe infecting the soil, and consequently the food distributed on such soil. There must, therefore, exist here conditions which essentially differ from those in the laboratory experiment; and it is reasonable to suppose that the contagium mixed with the soil and food is better secured against the action of the gastric juice than when mixed as a broth culture with food.

It has hence occurred to me that it might be possible to obtain greater success in plague feeding experiments by first protecting the contagium (B. pestis) by drying it along with the food, or by administering it with the food in such a state that some of it at any rate might pass unscathed through the stomach.

SERIES I.

In all experiments referred to in this report the rats used were, unless otherwise stated, tame or white rats. As I have explained in my reports for 1902-1903 and 1903-1904, tame white rats are highly susceptible to plague infection in all the various ways. Not so sewer rats. These rodents although susceptible to plague infection are so to a lesser degree than tame rats, and I have therefore limited myself to only few experiments with them. It would seem that tame rats (white or white and black) are in respect of susceptibility more nearly related to *mus rattus* (the oriental rat) than to *mus decumanus* (the brown sewer rat).

Experiment 1.—As already mentioned I have made a number of experiments in feeding guinea-pigs, rats, and mice, with virulent cultures of B. pestis (emulsion of recent gelatine and agar cultures, of broth cultures, of milk cultures), as also with the various fresh plague organs (lymph glands, spleen, liver and lung*), containing abundance of B. pestis; all of which experiments were without positive results. Of experiments of this class with fresh plague material and with recent cultures a single illustration will suffice :—

Two rats and two mice were fed with milk cultures (incubated five days at 37° C.) which when tested by subculture were crowded with living B. pestis. For feeding purposes the milk culture was mixed with bread. After the lapse of a week the same four animals and one additional rat were fed with similar milk culture and bread. All the animals, however, remained unaffected. A fortnight later they were cutaneously inoculated with a trace of a similar milk culture, and promptly succumbed with plague between the third and fourth day.

In the same way two guinea-pigs and two rats were fed with the organs (minced and mixed with green food and bread) of one of the above rats. No result followed. After ten days these animals were inoculated (the guinea-pigs subcutaneously, the rats cutaneously) with agar culture derived from the spleen of one of the rats of the above experiment. They all died of plague.

Experiment 2.—Three rats were fed with a mixture of bread and sloped surface gelatine and agar cultures of B. pestis. The gelatine cultures had been kept growing at 20° C. for some six, those on agar for some three weeks. At the margin of the slopes of these cultures both the gelatine and agar were dried up, but the free sloped surface was covered with typical colonies of B. pestis; colonies which were angular, granular, opaque, raised, and dry-looking. After melting the gelatine by immersing the tubes in warm water—in the case of the agar the glass tubes had to be broken—the contents of the tubes were mixed with bread. The above animals were fed with this mixture on May 2nd. In the morning on May 5th two of the rats, No. 1 and No. 2, were found

* These were derived from guinea-pigs and rats that had died with acute virulent plague. Such organs inoculated in minute doses into rodents produced acute and typical plague.

very ill, in fact dying; one died at about 10 a.m., the other at noon. The third rat (No. 3) looked quiet, its coat was rough and seemingly it did not feed. This rat did not improve for the next few days, but on May 8th was noticed to be again lively and to feed normally. It was killed on May 10th. The post-mortem examination of this animal did not reveal any pathological changes, and cultures made from the spleen and heart's blood proved sterile.

But the post-mortem examination of rats No. 1 and No. 2 showed the following appearances :—

Rat No. 1.—No swollen subcutaneous lymph glands. The omentum much congested with numerous petechiæ; in the lower ileum a patch of hæmorrhage around a swollen and partially necrotic Peyer's patch, the latter itself much injected but well marked off from the hæmorrhagic tissue around it; the mesenteric glands swollen, deep purple in colour, hæmorrhagic. Both testes showed the parenchymatous and superficial lymphatics filled with blood, and the lymphatics of the spermatic cord and pelvic lymph gland were in like condition.* The spleen was much enlarged, dark; both lungs congested; liver, kidneys, and suprarenals in like condition.

Film specimens were examined and cultures made—(*a*) of the mesenteric glands, (*b*) of the spleen, (*c*) of the heart's blood. In all these instances the film specimens showed crowds of B. pestis, and the cultures were crowded with colonies of B. pestis in pure state.

The hæmorrhagic patch of the ileum, and the Peyers gland, the kidney, liver, spleen, lung, mesenteric gland, and testes were placed in Müller's fluid, then in spirit. After completion of the hardening process these organs were used for preparing sections.

Rat No. 2.—The post mortem examination showed almost exactly the same appearances as those of Rat 1, except that the testes appeared free from any change. The lower ileum showed a hæmorrhagic patch in which there was a swollen prominent congested and partly necrotic Peyer's gland. The spleen, kidney, mesenteric glands, and lungs were similar to those of Rat No. 1.

Film specimens and cultures of the hæmorrhagic mesenteric glands, of the spleen, and of the heart's blood showed that these organs contained crowds of B. pestis. The hæmorrhagic patch and swollen Peyer's gland and the mesenteric glands were preserved in Müller's fluid with a view to afterwards making sections.

On examination, the stained and mounted sections of the intestinal hæmorrhagic patches and Peyer's glands, as also sections of the mesenteric glands, showed in both cases (Rat 1 and Rat 2) the same condition. It will suffice therefore to describe the appearances in one animal only, viz., Rat No. 1.

* I have seen this condition of the testes occasionally also in guinea-pigs which have succumbed with acute plague after subcutaneous injection.

As regards this rat, the appearances are shown in Figs. 1, 2, 3, and 4, Plates I. and II. Fig. 1, Plate I., shows a transverse section of the swollen Peyer's gland with margin of surrounding tissue, under low magnification (× 25). As is well seen, the Peyer's gland projects considerably on the serous (peritoneal) surface, and opposite this projection—*i.e.*, within the cavity of the intestine—is a mass of débris extending over the surface of the mucous membrane beyond the gland. Under a high power masses of bipolar stained B. pestis are recognisable in this débris as small and large clumps; they appear as dark stained patches. In some places (*e.g.*, in the neighbourhood of line 1) a large mass of B. pestis may be seen embedded in finely granular material, which is in fact a remnant of one of the original colonies in the agar with which the animal had been fed. The superficial part of the Peyer's gland—below the central mass 1—is necrotic tissue with a large amount of diffused blood. At 5, the mucous membrane (villi) is devoid of its surface epithelium; its mucosa shows numerous vessels distended by blood, and in its tissue is effused blood; so also around the crypts there is a good deal of effused blood. Masses of B. pestis are seen not only everywhere between the tissue elements of the villi, but also in the effused blood. At 2 and 3 in the space between swollen lymph-follicles, in the submucous tissue, is a large blood vessel distended by blood, and surrounding it is a lymph space densely filled with a continuous mass of B. pestis. Similarly at 4, lymph vessels situated between the inner circular and outer longitudinal layer of the muscular coat are filled with continuous masses of B. pestis. In this figure (1) these lymph spaces at 3 and 4 appear black; but in the actual specimen stained with methyl blue and eosin these parts are deeply blue, while the blood of the blood vessels is pink. Under a sufficiently high magnification the fact that the masses are composed of B. pestis is easily recognised.

In this animal, as also in others yet to be described—rats, guinea-pigs, and mice—sections through the hæmorrhagic patches of the mucous membrane over and around the affected Peyer's glands show some villi which present a remarkable appearance. Continuous streaks and masses of B. pestis (Figs. 6 and 7, Plates III. and IV.) not only cover the surfaces of the villi denuded of their epithelium, but extend between the tissue elements in the same reticular fashion as chyle does during absorption; moreover, in some instances the central chyle vessel appears distended and filled with the B. pestis. In particular villi the tissue is completely disintegrated by effused blood in which appear numerous B. pestis. Continuous masses of B. pestis are found also around the fundus of the Lieberkühn crypts, surrounding these like lymph spaces, as also within the cavities of the crypts.

In Fig. 2, Plate I., the distended blood vessels above referred to are shown somewhat more magnified (× 300). They are filled with blood in which abundance of small and large masses of B. pestis can be seen (black in the figure); the blood vessels are surrounded (perivascular lymph spaces) by the continuous masses

of B. pestis also mentioned above. This is specially shown in Fig. 3, Plate II. (× 1,000) which represents a point where the B. pestis are less densely packed, and therefore recognisable as such.

Fig. 4, Plate II., shows a section through the hæmorrhagic mesenteric gland, photographed under a low magnification (× 20). The gland is seen surrounded by fat tissue. Near the middle of the upper part, close to the capsule, is an afferent lymphatic (black) densely packed with B. pestis. At the right upper angle, within the fat tissue, is a blood vessel containing masses of B. pestis (black), In several places on the inside of the capsule, in situations corresponding to cortical lymph sinuses, are continuous masses (black) of B. pestis; so also in the medullary part. A good deal of the cortical part is more or less necrotic, and contains effused blood (light). In the actual specimens, double stained with methylblue and eosin, the contrast between the masses of B. pestis (blue) and those of blood corpuscles (pink) is very striking.

Sections through the spleen, kidney, liver, and lung of this rat show not only that the blood vessels up to their finest branches are distended with blood, and contain large numbers of B. pestis, but that in many places there is blood effused outside the vessels between the elements of the parenchyma, in which blood are a great many B. pestis in small and large masses. The spleen pulp is in many places literally packed with continuous masses of B. pestis in streaks and patches. Sections through the testis show the intertubular lymph spaces filled with blood, and amongst this continuous streaks and irregular clumps of B. pestis (*see* Fig. 5, Plate III.). In the liver the capillary blood vessels within the acini appear in some places almost as if injected with B. pestis, while the liver cells appear shrunk or full of fat globules. Sections through the lungs show, besides B. pestis present in some parts in the distended veins and capillaries of the minute bronchi and alveolar walls, that the alveoli contain blood and homogeneous exudation. Extravasation of blood *en masse* occurs in many parts of the peribronchial and interlobular connective tissue. Similar extravasations of blood *en masse*, containing numerous B. pestis, are met with in many places in the connective tissue between the cortex and medulla of the kidney. And small branches of veins in the cortex of the kidney, as also the capillaries of the glomeruli, contain numbers of B. pestis, forming in many capillaries continuous blocks.

[As mentioned above, the naked eye appearances and cultural results of rat 2 were the same as those of rat 1, and it is not necessary to describe again and for this animal the appearances of the sections made through the hæmorrhagic swollen Peyer's patch, the mesenteric glands, the spleen, the liver, and the kidney. They showed the same copious distribution of B. pestis in the blood vessels, in the lymphatics, and in the parenchyma.]

From these observations it is seen that out of three rats fed with stale and drying cultures, two succumbed to plague; that they showed not only definite changes of the intestine but in unmis-

takeable manner the exact spot or portal of the infection. Further, it is seen that not only was there abundance of B. pestis in the interior cavity of the affected intestine, but also that the lymphatics of the affected part of the intestine (villi, mucosa, submucosa, and muscular coat), the mesenteric glands, and the vascular system in general, had become literally crowded with the B. pestis. This is a result more intensive in respect of the distribution of the B. pestis in the affected animal than that which occurred after subcutaneous or cutaneous injection.

Experiment 3.—Four rats, Nos. 4, 5, 6, and 7 (kept in couples in cages), were fed on May 10th with bread mixed with gelatine cultures of B. pestis. The cultures were six weeks old and contained abundance of typical colonies; but the gelatine around them was almost dry, and the colonies themselves were dry looking and shrivelled.

Rat No. 4 was found dead on May 13th; rats Nos. 5 and 6 on May 14th. Rat No. 7 appeared quiet at this date, but by May 17th had become quite normal, and it remained so.

The post-mortem examination of rat No. 4 showed the following appearances:—Both mammary glands much congested and showing streaky hæmorrhages; sections through the hardened tissue showed a great deal of effused blood in the alveolar tissue, with numerous B. pestis. The omentum was congested, and there were numerous petechiæ in the ileum; a distinct patch of hæmorrhage was seen around a swollen Peyer's gland; the mesenteric glands were swollen and hæmorrhagic; the spleen was typically enlarged, dark, and firm; the other viscera were congested. Cultures and film specimens of the mesenteric glands, of the interior of the intestine at the seat of hæmorrhage, of the spleen, and of the heart's blood, showed copious presence of B. pestis.

Rat No. 5.—The whole of the lower ileum was relaxed and filled with a sanguineous mucus; several Peyer's glands were swollen and showed punctiform hæmorrhages; the mesenteric glands were swollen and showed hæmorrhages; the spleen and kidney were large and dark; the testes showed several hæmorrhagic patches, and their lymph vessels were injected with blood.

Cultures, film specimens, and sections of the hardened organs showed the same copious presence of B. pestis as mentioned in regard of the former animals. Sections through the various organs showed the same appearances of distended vessels and hæmorrhage along with copious presence of B. pestis, as was described in the case of rat No. 1.

Rat No. 6.—Several of the Peyer's glands of the ileum were enlarged and showed hæmorrhages; mesenteric glands slightly enlarged, congested; both testes showed lymph spaces and lymph vessels injected with blood. The spleen was large and dark. Cultures and film specimens of the Peyer's glands, of the mesenteric glands, of the spleen, and of heart's blood proved to be crowded with B. pestis. Sections through the various organs showed appearances as in the former case.

Here, then, there was positive result in three out of four cases; definite pathological changes of the intestine with intensive and extensive distribution of B. pestis.

Experiment 4.—Two guinea-pigs (Nos. 8 and 9) were fed at the same time (10th May) and with the same stock of gelatine cultures as were the rats of the previous experiment; with this difference only, that for the guinea-pigs the gelatine cultures were mixed with soft green food—cabbage leaves finely cut up. In all these feeding experiments it was of course essential that no pointed particles should be in the food in order to obviate the possibility of inoculation of the fed animal by pricks of its skin or mucous membrane. As a matter of fact, in no case was any such accident noticed—the animals either succumbed with definite lesions of the ileum denoting the place of entrance of infection, or they remained alive.

Guinea-pig No. 8 was found dead on May 16th.

The post-mortem examination showed a considerable portion of the lower ileum swollen, deep purple in colour, and hæmorrhagic; several Peyer's glands swollen and necrotic; the interior of this part of the ileum, as also of the adjoining portions, appeared filled with sanguineous matter, which in film specimens yielded B. pestis in pure culture. The mesenteric glands were swollen and hæmorrhagic, showing also several whitish grey necrotic foci. The liver and spleen were crowded with grey punctiform nodules.

Cultures were made of the intestinal contents, of the heart's blood, and of the spleen. As a result, in all cases pure cultures of B. pestis were obtained, except as regards cultures of the intestinal contents which contained a small number of B. coli in addition.

Two mice were inoculated cutaneously with a trace of the sanguineous intestinal contents of guinea-pig No. 8. One of these mice was found dead on the third day, the other on the fourth day. Both showed all the appearances of typical acute plague; the spleen and heart's blood were literally packed with B. pestis.

Sections were made through the hardened intestine, the mesenteric glands, the spleen, and the liver of the above guinea-pig, No. 8, and the results were practically the same as were described in regard of previous rats. In the swollen Peyer's patches the blood vessels were distended, with extravasation of blood *en masse*, and with B. pestis everywhere; the mucosa over and around the lymph follicles was filled with extravasated blood. Both the tissue of the mucosa and that of the lymph-follicles was necrotic; the lymph vessels and sinuses in the mucosa and submucosa were distended and filled with continuous masses of B. pestis. Necrotic patches were found in the mesenteric glands, in the liver, and in the spleen associated with masses of B. pestis.

Guinea-pig No. 9, which had been kept in the same cage as guinea-pig No. 8, remained alive. On May 30th it was injected

subcutaneously with a trace of gelatine culture of the heart's blood of its dead companion (guinea-pig No. 8). It died on the seventh day with all appearances of subacute plague: necrotic bubo; liver and spleen full of minute necrotic points; lungs congested with necrotic patches.

Film specimens and cultures were made of the bubo, the spleen, and the lung of this guinea-pig, and these showed copious presence of B. pestis.

[This experiment is instructive in that it bears out a fact on which in former reports I have repeatedly insisted, viz., that of two animals kept together in one cage, one may succumb to plague—its intestine, kidney, spleen, and blood in general literally swarming with B. pestis—whereas its companion may remain, and this notwithstanding blood-sucking insects with which guinea-pigs are well-provided, quite unaffected. If after 20 days the animal which has thus escaped illness be inoculated with B. pestis derived from its dead companion, it promptly succumbs to plague.]

Experiment 5.—Two mice, Nos. 1 and 2, were fed on May 4th with bread mixed with minced *fresh* spleen of a rat which had died of typical plague after cutaneous inoculation. The spleen in question was typical of plague; large, dark, and crowded with B. pestis. These mice remained unaffected. On May 16th they were inoculated cutaneously with a trace of a gelatine culture derived from the rat-spleen with which they had been fed. Both were dead of typical plague on the third and fourth day respectively.

Experiment 6.—Two mice, Nos. 3 and 4, were fed on May 20th with gelatine cultures of B. pestis. These gelatine cultures were 16 days old, and showed on their sloped surface crowds of typical colonies, somewhat dry at the margin.

Both mice were found dead in the morning of May 24th. One of them must have been dead for some hours as its abdomen was in an advanced state of putrefaction. But the other, which was in a good state of preservation, showed the following interesting appearances on post-mortem examination:—In the ileum a number of hæmorrhagic patches surrounding injected Peyer's glands; mesenteric glands swollen and hæmorrhagic; liver pale; spleen large, dark, and firm; kidneys much injected. Film specimens and cultures showed that the heart's blood and spleen were packed with B. pestis.

Sections through the hæmorrhagic parts of the intestine showed appearances similar to those already described in regard of rats fed in like manner. Not only was the actual infecting particle (full of B. pestis) found fixed to the intestinal mucosa, that is within the lumen, but the surface of the mucosa (villi) was denuded of its epithelium and covered with a continuous layer of B. pestis. These bacilli could be traced in almost continuous masses (*see* Figs. 6 and 7, Plates III. and IV.) into the villi, into the lymph spaces of the mucosa around the Lieberkühn crypts, and into the lymph vessels of the submucosa around and

between the lymph-follicles. The mesenteric glands were literally crammed with B. pestis forming denser masses corresponding to the subcapsular and medullary lymph sinuses.

Having thus satisfied myself that rats, mice, and guinea-pigs can be infected with plague by feeding them on old and drying gelatine and agar cultures, and that the intestines (ileum and Peyer's glands) of the experimental animals demonstrate in unmistakeable manner the exact place where infection occurred, I directed my attention to similar feeding experiments with grain, *i.e.*, with wheat and rice which having been mixed with minced plague organs of guinea-pigs or rats, or with gelatine cultures, had been allowed to dry. It is obvious that these further experiments more nearly represent conditions to which rats may become subjected as it were naturally.

Experiment 7.—The bubo, spleen, liver and lung of a guinea-pig that had died of plague after subcutaneous injection (guinea-pig No. 9 of Experiment 4) were (on June 6th) finely minced and then well mixed in separate plate dishes partly with wheat partly with rice. The two lots were placed over sulphuric acid to dry. On June 7th, *i.e.*, after 24 hours, the materials were found well dried, and were now used for feeding.

One dish (wheat and organs) was supplied to two rats in one cage, the other dish (rice and organs) to two other rats in a separate cage. Thus :—

Rats Nos. 10 and 11 were fed on June 7th with plague organs dried with rice. These two animals were distinctly affected on June 10th, and they were found dead on the morning of June 11th. On post-mortem examination the lower ileum in both animals was found intensely inflamed and showed hæmorrhages ; the mesenteric glands were swollen and hæmorrhagic ; spleen typical, large, dark, firm, and crowded with B. pestis.

Rats Nos. 12 and 13 were fed on June 7th with plague organs dried with wheat. One was found dead in the morning of June 10th, the other remained unaffected. The post-mortem examination of the dead rat showed in the ileum five different spots where hæmorrhage had taken place over and in the neighbourhood of Peyer's glands ; within the cavity of the ileum was a good deal of blood, and mingled with it crowds of typical B. pestis ; in the mesentery around the mesenteric glands was a big hæmorrhagic patch, while the mesenteric glands themselves were swollen and exhibited petechiæ. The spleen was large, dark, firm, and crowded with B. pestis ; both kidneys, which were twice the normal size, were deeply congested in all parts ; both lungs were congested with numerous hæmorrhagic spots. Film specimens and cultures of the intestinal sanguineous contents, of the spleen, and of the heart's blood yielded B. pestis. Sections were made of the hardened intestine through the hæmorrhagic spots, and Figs. 8, 9, and 10, Plates IV. and V., show the appearances observed.

Fig. 8, Plate IV., is from a transverse section through a hæmorrhagic part of the intestine close to a swollen Peyer's gland

(× 25). In the lumen of the intestine is seen a mass which is only the outlier of a larger mass attached to the inner portion of the Peyer's patch. Part of this central mass is shown more highly magnified (× 300) in Fig. 9, Plate V. Here may be recognised between two masses of wheat (*a*) and (*b*)—or what is left of wheat undigested—a streak of tissue, *cc*, which examined under a higher power × 1,000 (as in Fig. 10, Plate V.) shows itself to be a mass of ingested tissue, most probably a piece of spleen; and, further, there is seen in this tissue, as also in the part of wheat next to it at *b*, continuous masses and clumps of B. pestis which appear black in the figure. Likewise there is seen at *c* a dense mass of B. pestis surrounded by what under high power is recognisable as a necrotic portion of tissue, probably spleen. At (*a*) there are gluten globules and septa between them.

Here, then, is demonstration of a striking fact: In the lumen of the intestine exactly at a hæmorrhagic spot and next an inflamed Peyer's gland is a piece of the infected food—*i.e.*, plague tissue wedged in between two portions of wheat—which would seem to have become attached to a Peyer's patch during the life of the animal. In this food particle there are recognisable more or less undigested parts of wheat (gluten portions) and part of the original plague organ that was dried with it. Further, it would appear there had been active multiplication of plague bacilli in the adjoining loosened wheat particle.*

Fig. 10, Plate V., shows under a high power these streaks and masses of B. pestis between the layers of the remains of the wheat *a-a*, *b* being the original plague material dried in the wheat. It remains to be noted that many villi of Fig. 8, Plate IV., showed, when examined with a high power, crowds of B. pestis on the surface (denuded of epithelium) and in the tissue of the villi. Sections through the affected swollen Peyer's glands showed appearances like those previously described (Fig. 1, Plate I.). Particularly some villi showed hæmorrhages with numerous B. pestis, and others were crammed with B. pestis in the manner represented in Fig. 5, Plate III.

Sections through the hardened kidney showed appearances already described, but more pronounced, in respect of numerous hæmorrhages in the cortex and at the boundary layer. Almost all glomeruli showed some capillaries degenerated, others blocked with B. pestis; in many of the Malpighian corpuscles the cavity of the capsules contained blood and B. pestis. A like appearance was observed in many of the convoluted tubules.

It should be mentioned here that while in the actual specimens double stained with methylene blue and eosin the distribution of the B. pestis in the tissues is at once strikingly apparent owing to the contrast between the bacilli stained blue and the blood corpuscles red, in the figures submitted this contrast is lost; owing to the low magnifying power and to dense packing of the B. pestis these collections are only indicated as black masses.

* This observation does not lend support to Hankin's contention that the wheat offers antagonism and inhibition to the life and multiplication of B. pestis brought in contact with it.

In addition to the above experiments, I have obtained a number of other positive results from feeding rats with wheat and rice mixed with finely minced plague organs and dried over sulphuric acid for two or even three days. It is, however, unnecessary to describe all of them in detail; they fully confirm the above observations.

Experiment 8.—Parts of the organs (spleen and liver) of plague rat No. 12 were finely cut up and mixed, in separate dishes, with wheat and rice, and placed on June 11th over sulphuric acid. After 48 hours (June 13th) the materials were found quite dry and extremely hard and brittle. They were now given as food to two white mice (No. 5 and 6) (rice plague organs) and to three wild mice (No. 7, 8, 9) (wheat plague organs). The animals ate all the food within 24 hours. One of the white mice was found dead on June 16th. It had extensive skin disease and a big worm in the liver, but its intestine and spleen were not affected. The other white mouse and the three wild mice remained alive and unaffected.

From this it would seem that the material had been dried too much, and that probably all plague bacilli in them had been killed.

Experiment 9.—This experiment was made in repetition of Experiment 8. Wheat and rice were mixed with old gelatine cultures of B. pestis (derived from blood and spleen of rats and mice dead of plague after feeding), and the mixed materials dried over sulphuric acid for 24 hours. The materials were then, 21st June, given to rats, two for each lot. One of the rats (No. 14), fed with wheat gelatine culture, was found dead in the morning of June 25th, the companion (No. 15), pregnant, was very ill and was killed. On post mortem examination this animal (15) contained seven dead foetuses nearly full time; there was a great deal of peritonitis; the spleen was small and had no plague bacilli; there was no appearance of plague.

But the post mortem examination of rat No. 14 showed lesions in the ileum and Peyer's glands, mesenteric glands, and spleen, identical with those already described. It is not necessary therefore to further refer to them beyond saying that film specimens and cultures of the hæmorrhagic mesenteric glands, of the spleen, and of the heart's blood showed abundance of B. pestis. The rice-fed rats both remained alive, and showed no alteration in their condition.

Experiment 10.—A guinea-pig which had been inoculated with plague having died, its organs—bubo, spleen (full of B. pestis)—were finely minced, and then mixed well with wheat and flour, and placed over sulphuric acid. After 24 hours the material, which was now perfectly dry and hard, was given (June 28th) as food to three white and to three wild mice.

On July 1st one of these wild mice was found dead. The ileum was relaxed and full of sanguineous mucus; petechiae in the mucous membrane; mesenteric glands much injected and swollen; spleen literally packed with B. pestis. The kidneys, lungs, and the liver were hardened and sections were made. In all these

organs great congestion of the blood vessels was found and in the large and small vessels numerous B. pestis; in the kidney some of the capillaries of the Malpighian tufts were quite blocked with them.

The other two wild mice remained alive.

Of the three white mice one was found dead on July 11th, *i.e.*, after 13 days, and post mortem examination showed the following conditions: Ileum much congested; at one spot around a swollen more or less necrotic Peyer's gland, the mucous membrane was hæmorrhagic; the mesenteric glands swollen and hæmorrhagic; the spleen much enlarged, dark, and firm.

Sections through the swollen Peyer's gland and surrounding membrane showed almost complete necrosis, the tissues being permeated with effused blood, and the lymphatic vessels blocked with continuous masses of B. pestis. The mesenteric glands were necrotic, the lymphatics here being filled and distended with masses of B. pestis.

The other two white mice remained alive.

In a number of other experiments old gelatine cultures of plague bacillus or actual particles of plague organs were mixed with wheat, rice, and flour, and were then left over sulphuric acid for more than three days. As a result the materials became thoroughly dry; too dry, in fact, as negative result of feeding rats and mice with them showed—the animals remaining unaffected. More than 48 hours' drying over sulphuric acid appears to preclude expectation of B. pestis remaining present in the material in a living state.

From these experiments it appears:—

(1.) That rats, mice, and guinea-pigs are capable of infection with plague by feeding them with old* and drying gelatine cultures alone; with old gelatine cultures mixed with wheat or rice and then well dried; and with pieces of plague-organs mixed with wheat or rice or flour and then dried.

(2.) That of animals thus fed a considerable percentage become infected; that the infection takes place in the ileum at or about the Peyer's glands; and that the infected animals die between the 4th and 6th day.

(3.) That hæmorrhage with great multiplication of plague bacilli occurs in the ileum at the point of infection, and this not only in the cavity of the intestine and on the free surface of the mucous membrane, but also within the villi themselves, in the absorbents of the villi and of all parts of the intestinal wall; and further in the mesenteric glands, whence the vascular system of the other viscera become crowded with the bacilli.

(4.) That the positive results obtained by feeding with semi-dried or more completely dried gelatinous plague materials—*e.g.*, gelatine cultures and plague organs dried by themselves or mixed with

* By old I do not mean gelatine cultures which are practically dead and have lost all virulence, but gelatine cultures from two weeks to two months old, and which yield active and living sub-cultures.

food stuffs (wheat, rice, flour)—are in marked contrast to the negative results of feeding with fresh plague materials—*e.g.*, fresh milk cultures, broth cultures, watery emulsions of cultures of B. pestis and fresh plague organs.

(5.) That it is, therefore, justifiable to assume that the positive results in the former cases are due to the gastric juice failing to reach the central portions of the infective food particles, the plague bacilli in these central portions being left undisturbed and unaffected owing to the protection afforded them by the outer dried shell of material.

In a word, I am inferring that on their passage through the stomach the infective materials would retain some of the plague bacilli protected and living; that on reaching the ileum the infective particles would, by the absorptive tendency of the Peyer's glands, become fixed as it were on these glands, and that the living plague bacilli within the material thus affixed to the mucous membrane would at once commence to multiply *in situ* causing thereby the changes which were actually found, viz., hæmorrhage and necrosis and charging of the absorbents with B. pestis, with the result of general infection of the rest of the body.* Similarly I am inferring that the negative results of

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* As direct evidence bearing on this point the following observation deserves to be mentioned.

A guinea-pig was inoculated cutaneously on April 11th with a particle of the spleen of a rat dead of acute plague. This guinea-pig was found dead on April 17 showing the following post mortem appearances: large necrotic bubo with hæmorrhage around it, while the spleen, liver, and lung contained numerous necrotic nodules crowded with the B. pestis; that is to say the animal presented the appearances of sub-acute plague which follows the cutaneous inoculation. But in addition a portion of the lower ileum of this guinea-pig showed great hæmorrhage with a blood clot in its cavity firmly adhering to the mucous membrane, while the mesenteric glands were enlarged and showed hæmorrhages; there were hæmorrhages also—besides those mentioned—in the subcutaneous tissue surrounding the inguinal bubo, also in the testis and omentum. Sections were made of the hæmorrhagic portion of the ileum and of the mesenteric glands. These showed: (*a*) in the ileum and firmly adhering to the mucosa (villi) a mass of blood, in which were large numbers of nests of B. pestis; the tissue of the villi were full of B. pestis forming reticulated masses, as described and figured of former cases, in which infection had started from the intestine; the central chyle vessel, as also the lymph vessel of the mucosa, was literally crowded and injected with B. pestis, as were also the lymph vessels of the submucosa and of the outer muscular coat; in the mesenteric margin of this part of the intestine the efferent chyle vessels were distended and filled with blood and with masses of B. pestis; the large blood vessels of the same parts were also filled with blood amongst which some B. pestis could be recognised: (*b*) the mesenteric glands showed the same appearances as were described on a former page, viz., the afferent and efferent lymph vessels were distended and filled with B. pestis, so also were the cortical and medullary lymph sinuses; a great deal of hæmorrhage was noticeable in the cortical lymph follicles.

The appearances above described appear to me to admit of one interpretation only, viz., this: In the ileum hæmorrhage had taken place, witness the presence of a blood clot in the cavity; the B. pestis in this clot being in a suitable place—the ileum—had multiplied and had become readily absorbed by the villi in which indeed they abounded; the same process had followed in all the absorbents of the intestinal wall and mesenteric glands. This was evidently made possible by the duration of the disease (six days). So that a direct lodgment of B. pestis in the intestinal cavity having occurred while the animal continued to live, time was given for a *secondary infection* of this part of the ileum of the same character as that observed in the other cases in which the B. pestis had reached the ileum by way of the food.

feeding with fresh materials are due to all the ingested plague bacilli becoming readily exposed to the action of the gastric juice so that no living plague bacilli are capable of reaching the ileum, and that the animal therefore escapes.

It must be obvious from the above description that the discharges of the intestine and the secretion of the kidney in animals (rats, mice, or guinea-pigs) affected with plague by feeding, in all probability contain abundance of plague bacilli. It has been seen that the materials within the cavity of the ileum of such animals swarm with B. pestis, and that these materials on inoculation promptly produce plague. Likewise it appears that plague bacilli are abundant in the malpighian corpuscles (glomeruli and capsules) and in the uriniferous tubules.* These facts in no way support a contention such as that put forward by Hankin in the Journal of Hygiene, to the effect that the intestinal or renal discharges of the plague-rat are not to be regarded as materials capable of causing infection. On the contrary, the observations I have recorded go to justify a contention that, as regards rats which have contracted plague by feeding, the dejecta in question, teeming as they needs must with B. pestis, are to be regarded as in all probability infective. Indeed, in view of the ready transmission of plague to the rat by means of feeding with infected grain, rice, flour, and the like, the foregoing experiments afford strong suggestion that the excreta of a plague-rat becoming mixed and dried along with food stuffs may be the starting of extensive plague infection of the rats feeding on these substances contaminated by stale plague dejecta.

In connection with the above propositions, it has to be borne in mind that the anatomical lesions in the ileum which I have described cannot be of a single day's duration; that the necrotic changes in the mucous membrane and in Peyer's glands caused by the multiplication of B. pestis within the cavity of the ileum must have occupied time in development, and that accordingly there must have arisen ample opportunity for B. pestis to pass into and out from the large intestine with the alvine evacuations of the infected animal.

It is not possible to deny that similar conditions might occur in respect of human beings; that food stuffs having become polluted, with, say, excreta of plague-rats preserved in a semi-dried or dried condition, might cause plague in persons ingesting them, the point of infection in such case being the intestine itself.

Simpson's contention (Report on plague in Hong Kong) that the septicæmic form of plague in man (in which the whole blood system and all organs contain abundance of B. pestis) may be caused by infection of man's intestine by means of food, was based

* As a matter of fact I have made a number of experiments (which need not be described in detail) in which the sanguineous mucus of the inflamed intestine of animals (rat and guinea-pig) dead of plague after inoculation was used for cutaneous as also subcutaneous injection, and by which fatal plague of the animals so inoculated (guinea-pigs and rats) was the result. I have also made inoculation experiments (subcutaneous) of guinea-pigs, employing the urine drawn from the bladder of guinea-pigs or of rats which had succumbed to (hæmorrhagic) plague, and the result was positive in the majority of instances.

on experiments in which wild rats were fed with fresh plague organs; these rats, or some of them, having died, plague was considered to have been induced in them by way of the intestine. This inference seems to me, however, not justified, or at least not proven, and for two reasons:

(1.) The fact that the rats in question died, as is said by Simpson, from the septicæmic form of plague does not afford presumption that they were infected by ingestion; the septicæmic form of plague being that under which both rats and mice and also guinea-pigs commonly die after inoculation.

(2.) No indication is given by Simpson of any such conspicuous and definite local infection (hæmorrhage) in the ileum and in Peyer's glands as that described by me as resulting in those of my feeding experiments which proved positive.

The general congestion of the small intestine mentioned by him (in addition to sanguineous mucus in the intestinal cavity) is not, be it observed, an uncommon feature in the rat and mouse dead of plague contracted otherwise than by feeding; it is not uncommon too in rodents which have died of septicæmic diseases other than plague. In the guinea-pig dead of plague after subcutaneous injection I have not unfrequently found the whole of the intestine showing punctiform hæmorrhages. Also I have observed hæmorrhage in the testis, whence the effused blood could be traced by the absorbents of the spermatic cord into the pelvic lymph gland.

On the other hand it is possible, in view of the experiments I have been describing, that Dr. Simpson's view may prove on the whole to be correct, and this mainly for the reason that in the septicæmic form of plague of the human subject the blood and the organs appear crowded with B. pestis, as was the case in the animals of my feeding experiments. Before, however, definitely pronouncing on this point, it would be necessary to make careful post mortem examination of septicæmic plague in man for the purpose of ascertaining whether local infection (ileum and Peyer's glands) and changes of the mesenteric glands similar to the conditions described here in regard of experimental animals, has actually occurred.

Among the many interesting facts concerning the spread of plague in India ascertained by the Indian Plague Commission are those pointing to persistence for some considerable time of the contagium of plague in rooms and streets from which all plague cases had been removed; rooms or streets for instance are cited in which plague broke out afresh on the return to them of the inhabitants. Hankin, however, it appears (see also Report of Indian Plague Commission) had made experiments on the vitality of the B. pestis in soil, and had found this to be of very short duration. These experiments of Hankin have been relied on by commentators as justifying the view that the observed persistence of infectivity in rooms and streets after removal therefrom of infected persons might have been due

to retention of the contagium by rats or by fleas; in a word to the contagium having been kept alive as it were by these means.

Before, however, accepting such interpretation of the facts it seemed to me necessary to ascertain whether the vitality of B. pestis in soil is really of short duration; whether the result might not have been different if instead of distributing B. pestis in the soil, as practised by Hankin, in the form of a broth culture it had been applied under conditions more nearly approaching those in which it would naturally find access to soil, *e.g.*, in blood, in discharges of a suppurating bubo, in mucus expectorations, in the mucoid discharges from the bowels of a plague-rat, in the juices of plague organs, or in similar viscid or slimy materials.

Accordingly I have made a series of experiments in this direction, and have thereby ascertained that B. pestis planted in or mixed with soil in the above manner has considerable power of persistence. Also I have made experiments with wheat and rice on the same lines; that is I have sought to ascertain for what length of time the bacilli in plague materials (cultures or organs) mixed with wheat or with rice can retain their vitality.

Series II.

Gelatine cultures, about six weeks old, were melted in warm water and poured over earth (fine gravel) contained in a glass dish (July 2nd), and over fine sand (July 1st) contained in a separate glass dish. The earth and the sand were in each instance thoroughly mixed with the gelatine and then placed over sulphuric acid, of course in a hermetically closed space. The earth as also the sand were (after being kept not more than 24 hours over sulphuric acid) found perfectly dry and hard. After having been thus dried during one, two, three or more days, a small amount (about $\frac{1}{2}$ to 1 gramme) of the infected earth or sand was in each instance taken out, placed in a sterile watch glass and distributed (rubbed down) in a few cubic centimetres of warm sterile water so as to form a turbid emulsion. Of these turbid emulsions small quantities in each instance (about $\frac{1}{10}$, $\frac{1}{5}$, $\frac{1}{2}$ cc.) were injected subcutaneously into guinea-pigs. This method of procedure was chosen in preference to mere cutaneous inoculation of rats, for the reason that the object was to ascertain not whether living plague bacilli were present in a small droplet (the quantity that could be introduced by cutaneous inoculation) but whether *any* living plague bacilli were left in fair quantities of the materials.

Experiment 1.—Guinea-pig No. 1 injected with "sand-gelatine" after 24 hours' drying, on July 2nd. Guinea-pig No. 2 injected with "earth-gelatine" after 48 hours drying, on July 4th.

Guinea-pig No. 1 devoloped a big bubo and died on July 7th with typical sub-acute plague. Post-mortem examination showed

a necrotic bubo with crowds of B. pestis; spleen and liver dotted all through with white nodules full of B. pestis.*

Guinea-pig No. 2 developed a bubo slowly; it was found dead on July 11th. Post-mortem examination showed typical sub-acute plague.

Experiment 2.—Guinea-pig No. 3 was injected (on July 4th) with "sand-gelatine," dried for three days. Guinea-pig No. 4 was injected on July 5th with "earth-gelatine," dried for three days.

Guinea-pig No. 3 developed bubo slowly; this became a big abscess by July 13th. The same condition was observed with guinea-pig No. 4. But both animals appeared otherwise lively. Both were killed, and on post-mortem examination the pus of the bubos was found to contain, amongst cocci, crowds of B. pestis. The viscera appeared unaffected.

Experiment 3.—Both the dishes containing "sand-gelatine" and "earth-gelatine," were removed from over the sulphuric acid after lapse of three days and were then kept under a simple glass cover (raised about half an inch at one side) at the temperature of the laboratory.

Six days after withdrawal from the influence of the sulphuric acid, the "sand-gelatine" was used for subcutaneous injection (on July 9th) of guinea-pig No. 5; and five days after withdrawal the "earth-gelatine" was used in similar manner for injection (on July 9th) of guinea-pig No. 6.

Guinea-pig No. 5 was on 15th July without tumour and quite lively; and it remained so. Guinea-pig No. 6 died on this day (July 15th). On post-mortem examination there was evidence of typical sub-acute plague; big necrotic bubo with crowds of plague bacilli, liver and spleen permeated with minute white nodules containing numerous B. pestis.

Experiment 4.—After a further week's (July 16th) withdrawal from sulphuric acid, the samples having been kept meanwhile at the room temperature and in the air of the laboratory, the same "sand-gelatine" and "earth-gelatine" were used for injection of guinea-pigs Nos. 7 and 8 respectively. The "earth-gelatine" appeared now as dry and hard as brick. The "sand-gelatine" guinea-pig (No. 7) remained without swelling and quite well; whereas the "earth-gelatine" guinea-pig (No. 8) developed a small firm nodule at the seat of inoculation. This, however, almost entirely disappeared in the course of a fortnight, the animal remaining lively and well.

From these experiments it appears that gelatine cultures mixed with sand and earth can be dried over sulphuric acid

* It may not be unnecessary to state that in all experiments mentioned in this report, inclusive of all animals without exception dead or killed after plague infection, stained film specimens of all affected organs, and culture on gelatine from the bubo (when present), from the intestine (when affected), from the spleen and from the heart's blood, were made invariably and as a matter of ordinary routine.

for three days, until for instance the material becomes distinctly hard and dry, without the plague microbes losing their vitality; and further it appears that the "earth-gelatine" kept for additional five days till it had become as hard as brick, still retained living and active B. pestis.

Experiment 5.—In this experiment gelatine cultures about six weeks old were (June 30th) melted in warm water and poured over wheat and rice in separate glass dishes. After being well mixed in each instance the materials were placed over sulphuric acid, of course in a hermetically closed space.

On July 1st, *i.e.*, after 24 hours, the materials being now quite dry, a little of each sample was placed in warm water and a guinea-pig was injected subcutaneously with the emulsion thus obtained; viz., guinea-pig No. 9, with "rice-gelatine" and guinea-pig No. 10 with "wheat-gelatine." Both animals developed big tumours in the groin. Guinea-pig No. 10 which appeared otherwise lively on July 5th was killed on that date, and on post-mortem examination showed the following conditions :—

Extensive œdema over abdomen and chest; about the place of inoculation a big cavity filled with grumous fluid. Spleen not enlarged, no bacilli in it. In the inguinal fluid were crowds of diplococci and streptococci; as also numerous bipolar baccilli like B. pestis. With a dilution of the inguinal fluid an agar plate was made, and this brought forth crowds of colonies just like those of B. pestis. A guinea-pig, No. 11, was injected with one of these plague-like colonies. This animal was found dead on the 5th day, and gave evidence of typical plague with the typical distribution of B. pestis in the bubo and spleen.

Guinea-pig No. 9, which had been injected with the rice-gelatine, devoloped a big abscess in the groin and thigh; on the 8th day it was quiet and off its feed, and the bubo having opened spontaneously was discharging pus. This animal, which was better and fairly lively again on the 13th day, was now killed, and showed the following post-mortem appearances: In the inguinal region and about the thigh was a big cavity containing grumous creamy pus; spleen and liver and also lungs showed numerous minute white nodules. In the pus of the inguinal abscess were numerous clumps of B. pestis.

Series III.

In this series a number of animals were inoculated with earth and with sand which, after addition of small particles of plague organs, had been dried for various periods at the ordinary temperature of the laboratory.

Experiment 6.—Of a guinea-pig dead on July 7th with typical sub-acute plague, bits of the necrotic bubo, and pieces of the spleen and liver (full of minute nodules), were finely minced and mixed separately in glass dishes with earth (fine gravel) and fine

sand. These materials were then so placed as to obtain fairly free access of air,* and were left to dry spontaneously.

On July 14th, *i.e.*, after one week, a small amount in each case of the dry material was emulsified in warm water, and of each emulsion about ¼ to ½ c.c. was subcutaneously injected into a guinea-pig. These guinea-pigs will be designated :—

No. 12.—"Sand-plague" guinea-pig.

No. 13.—"Earth-plague" guinea-pig.

Guinea-pig No. 12 was found dead on July 18th, *i.e.*, after 4 days; it had, however, been dead for some time, July 17th being a Sunday. The post-mortem examination showed typical plague (early stage of sub-acute); viz., necrotic bubo, and few minute nodules in spleen and liver. Bubo and spleen were crowded with B. pestis as shown by film specimens and by cultures.

Guinea-pig No. 13 was dying on July 21st. On post-mortem examination there was found a big necrotic bubo crowded with B. pestis; the spleen, liver, and the lungs were crowded with necrotic nodules and patches; film specimens and cultures yielded pure cultures of B. pestis.

Experiment 7.—The materials of experiment 6 were used for inoculation of guinea-pigs after a further week of drying, viz., on July 21st. By this date the materials appeared perfectly dry and hard as bricks.

Guinea-pig No. 14 was injected with emulsion of the "sand-plague" organs.

Guinea-pig No. 15 was injected with emulsion of the "earth-plague" organs.

Guinea-pig No. 14 remained without swelling, and was altogether unaffected; it was killed on August 2nd, and gave totally negative result as regards plague. But guinea-pig No. 15 was distinctly ill on July 26th and had bubo. It was killed on the same day, and showed the following appearances: necrotic bubo; spleen, liver, and lungs crowded with necrotic nodules and patches. Film specimens and cultures of the bubo, spleen, and lung yielded crowds of B. pestis.

Fig. 12, Plate VI., shows, in a section under a low power, a necrotic nodule of the spleen containing aggregations (black) of B. pestis; these aggregations being in reality in networks of blood spaces of the pulp tissue.

Fig. 13, Plate VII., shows, in a section (x 100) through the lung, one of the nodules (this being in reality an infundibulum with its alveoli), all blocked with masses (black) of B. pestis.

From this experiment it appears, therefore, that while "sand-plague" material dried for 14 days at the ordinary temperature

* The glass dishes were kept under a bell glass, raised all round about ¼ to 1 inch, and placed by the open window.

was barren of infective power, "earth-plague" material still retained its efficacy. The former was therefore discarded, but the latter was retained for further experiment.

Experiment 8.—With emulsion of the same "earth-plague" material now dried for three weeks, guinea-pig No. 16 was injected on July 28th. This animal appeared unaffected on August 3rd, *i.e.*, after 6 days. It was killed and found in all respects normal.

Thus, earth subjected to admixture with the juice and particles of plague organs and allowed to dry, retained its infective power for a fortnight, but after lapse of 3 weeks proved barren of infectivity. It is to be noted that these experiments were carried out during the hottest part of the year, when the drying was fairly rapid and thorough.

Experiment 9.—The blood, bubo, spleen, and liver of a rat dead of acute (inoculated) plague were, on July 8th, finely minced and mixed with sand and earth; these materials being then put away to dry spontaneously, a fair amount of ventilation being in each instance allowed. In this condition the materials were kept for 8 days (July 16th); they were then placed over sulphuric acid for 3 days (July 19th), by which time they were quite dry and as hard as bricks.

On this date, *i.e.*, July 19th, emulsions were made and used for the subcutaneous injection of guinea-pigs.

Guinea-pig No. 17 was injected with "sand-plague" organs.

Guinea-pig No. 18 was injected with "earth-plague" organs.

Guinea-pig No. 17 developed a small abscess on the abdomen, but otherwise remained lively. Guinea-pig No. 18 showed a gradually increasing soft tumour (abscess) in the groin, which by the end of the week (July 26th) had reached the size of a pigeon's egg; the animal, however, appeared otherwise lively. Both were killed on July 27th, but with negative result *quâ* B. pestis. Guinea-pigs injected with the pus of guinea-pig No. 17, as also with the pus of guinea-pig No. 18, remained unaffected.

Experiment 10.—Rice and wheat were in each instance mixed, on July 11th, with finely minced bits of spleen and lung of a guinea-pig dead of typical sub-acute plague, and placed to dry spontaneously in the same manner and under the same arrangement as in the previous experiment.

On July 21st, that is after 10 days, the materials were found quite dry, and were used for making emulsions in warm water for injection subcutaneously of two guinea-pigs:—

Guinea-pig No. 19.—"Rice-plague" organs.

Guinea-pig No. 20.—"Wheat-plague" organs.

Both animals remained without tumour and lively. They were killed after one week and were found quite normal.

Experiment 11.—A guinea-pig died on September 27th from typical sub-acute plague. Its organs (bubo, spleen, liver, and lungs) were finely minced, mixed with sand and with earth respectively, and placed to dry spontaneously in the laboratory under the same conditions as in previous experiments. By the end of a week (October 4th) the materials seemed fairly dry and were used to inject guinea-pigs :—

Guinea-pig No. 21.—" Sand-plague " organs.

Guinea-pig No. 22.—" Earth-plague " organs.

Guinea-pig No. 22 was found dead on October 7th with very intensive acute plague ; guinea-pig No. 21 was found dead on October 10th with typical sub-acute plague.

Experiment 12.—The same "sand" and "earth" plague materials were used for injection of guinea-pigs on October 11th, that is after a fortnight's drying :—

Guinea-pig No. 23.—" Sand-plague " organs.

Guinea-pig No. 24.—" Earth-plague " organs.

Both animals were found dead on October 17th with typical sub-acute plague.

Experiment 13.—The materials of 27th September were used for experiment on guinea-pigs on October 20th, *i.e.*, after 23 days' drying :—

Guinea-pig No. 25.—" Sand-plague " organs.

Guinea-pig No. 26.—" Earth-plague " organs.

Both animals remained alive and unaffected.

Experiment 14.—Gelatine cultures of B. pestis, directly derived from rats and mice dead of plague after feeding and about 14 weeks old, were on October 8th melted in warm water, mixed with sand and with earth, and left spontaneously to dry in the laboratory in the manner described in previous experiments. Nine days later (October 17th) these materials were used for injection of guinea-pigs :—

Guinea-pig No. 27.—" Sand-gelatine " plague.

Guinea-pig No. 28.—" Earth-gelatine " plague.

Guinea-pig No. 28 was found dead on October 24th with typical sub-acute plague.

Guinea-pig No. 27 was found dead on October 26th with typical sub-acute plague.

Experiment 15.—The above materials were used again for injection of guinea-pigs on October 26th, *i.e.*, after 18 days' drying :—

Guinea-pig No. 29.—" Sand-gelatine " plague.

Guinea-pig No. 30.—" Earth-gelatine " plague.

Guinea-pig No. 29 died November 1st with typical sub-acute plague.

Guinea-pig No. 30 was found dead on November 2nd with typical sub-acute plague.

Experiment 16.—These materials were again used on November 7th, *i.e.*, after 30 days' drying, for injection of guinea-pigs :—

Guinea-pig No. 31.—" Sand-gelatine " plague.

Guinea-pig No. 32.—" Earth-gelatine " plague.

Guinea-pig No. 31 was found dead on November 16th with typical sub-acute plague.

Guinea-pig No. 32 was found dead on November 14th with typical sub-acute plague.

Experiment 17.—The materials were again used for injection of guinea-pigs on November 22nd, *i.e.*, after 6 weeks' and 3 days' drying :—

Guinea-pig No. 33.—" Sand-gelatine " plague.

Guinea-pig No. 34.—" Earth-gelatine " plague.

Guinea-pig No. 34 was found dead on November 26th with typical sub-acute plague.

Guinea-pig No. 33 remained unaffected. It was tested after a fortnight by the subcutaneous injection with plague culture and was found fully susceptible.

Experiment 18.—The same earth-gelatine plague was again used on November 29th, *i.e.*, after 7 weeks and 3 days drying, one guinea-pig, No. 25, being injected with it. The animal was found dead with typical sub-acute plague.

Experiment 19.—The last experiment with this same material, viz., "earth-gelatine" plague, was made on December 14th, that is, after 9 weeks and 4 days drying, one guinea-pig, No. 36, being injected subcutaneously with turbid emulsion. The animal remained unaffected. This animal a fortnight later was injected with B. pestis of culture and promptly succumbed to plague.

From this series it appears that the vitality of B. pestis in earth and in sand to which the micro-organism had been added in the form of gelatine culture remained, during the autumn months, for a long period unimpaired. Indeed, B. pestis was present in a living state in the earth even after $7\frac{1}{2}$ weeks ; in the sand for 6 weeks and 3 days. These are periods of considerable duration, much longer than were found in the previous experiments (Series III., Experiment 7) in which the infective materials were exposed to drying during the summer months. In these later experiments of early winter the infective materials were old gelatine cultures, not plague organs, and they were left to dry spontaneously under conditions such as might occur naturally. The fact that plague contagium is, under gelatinous or viscid conditions

and during the cooler months of the year, capable of retaining its vitality in sand and particularly in earth for a considerable time is a circumstance having no small importance, seeing that under natural conditions during plague seasons plague expectoration and intestinal mucus charged with masses of the B. pestis cast upon the earth may very possibly in like manner long retain dangerous infective property.

SERIES IV.

As a last series I have to mention some experiments in which plague organs were, by themselves, without admixture with other material, exposed to drying, and were then used for feeding rats, both tame and wild. The organs in question—bubo, spleen, lung, and liver, containing abundance of B. pestis—were obtained from animals (guinea-pig and rat) dead of typical acute plague. These organs, after having been cut into fair-sized pieces, were put to dry over sulphuric acid.

Experiment 20.—The organs of a guinea-pig dead of sub-acute plague which had been cut up in small bits and kept over sulphuric acid for seven days were by this time perfectly dry and hard. Two rats were fed with this material. Both animals remained unaffected; they were at the end of a week injected cutaneously with agar culture (24 hours old) of B. pestis derived from a recent case of plague in man (case from ss. *Weybridge*) which had been landed at Denton in December, 1904. Both were dead of acute plague in three days.

Experiment 21.—The organs (bubo, spleen, liver, and lungs) of two rats, dead of plague after having been inoculated cutaneously with the blood of a guinea-pig dead of acute plague, were cut up into small bits and dried over sulphuric acid for eight days. With this material, by this time quite dry and hard, two wild rats were fed. Both animals remained unaffected.

Experiment 22.—The organs of a guinea-pig dead on February 22nd of acute plague were cut up into bits and dried over sulphuric acid for 48 hours. By this time the outside of the material was well dried, though the inside remained still moist. With this material two tame rats in one cage, and two wild or sewer rats in a second cage, were fed on February 24th.

One of the sewer* rats was found dead on February 28th, the other remaining, by then and afterward, seemingly unaffected. Both tame rats at this date seemed ill, and showed rough coats. The post-mortem examination of the dead sewer rat showed the following conditions: The greater part of the lower ileum congested, relaxed, and filled with blood and mucus; at one point of the congested ileum a Peyer's gland appeared swollen, much

* The wild rats used in these experiments were all of the common brown sewer rat type.

projecting, and necrotic, the membrane forming around it a well-marked ring of hæmorrhage; the mesenteric glands were enlarged and hæmorrhagic (Fig. 11, Plate VI.); the spleen large, dark, and firm; the lungs of both sides were much congested and showed hæmorrhages. The sanguineous mucus of the ileum, the mesenteric glands, the spleen, and the lungs were crowded with B. pestis (as was proved by film specimens and cultures); the blood also contained abundance of B. pestis.

In this case, therefore, there was distinct and direct evidence that plague had been contracted by the feeding; for here as in former positive cases, the point of infection was anatomically easily located in the ileum at a Peyer's gland. Sections made through these parts fully confirmed this inference.

A small particle of the sanguineous mucus from the ileum of the dead sewer rat was injected subcutaneously into a guinea-pig, and the rest of the mucus was mixed with bran and oats, dried over sulphuric acid and then given as food to two wild rats. As a result, the two rats thus fed remained unaffected, whereas the inoculated guinea-pig sickened and became affected with typical sub-acute plague, the subcutaneous injection causing a huge hæmorrhagic and necrotic bubo in which was abundance of B. pestis.

It is of interest to notice in regard of this experiment 22, that a plague rat had been in the same cage with another rat, which remained unaffected though fed with plague material like its fellow—as indeed had happened in previous experiments, Series I. and II. In these conditions, therefore, there was abundant opportunity for transmission of plague by fleas or other blood sucking insects, such as lice, from the affected animal to its companion living with it in the same small cage; moreover, the animal that sickened with and died of acute plague about the 4th or 5th day had plenty of B. pestis in its blood. It is not to be supposed that common sewer rats such as were used in these experiments were without fleas or lice, nor can it be supposed that the fleas of the rat that died did not leave this rat for the living rat, a practice of fleas noticed and recorded by several observers. On making the post-mortem examination no fleas but only lice could be found on this dead rat,* though during life the animal was frequently observed to scratch itself in the manner customary with rats. Notwithstanding, therefore, all these circumstances specially favourable for the transmission of plague, the companion rat remained unaffected. Here was a rat the blood of which was teeming with B. pestis; further, close at hand, was a companion rat ready for any supposed fleas or lice to migrate to; and yet this companion rat remained unaffected by plague. Nevertheless this companion rat when later on (after lapse of a week) it was cutaneously inoculated into the skin of the root of tail with a trace of gelatine culture directly made of

* It should be here added that I have not been able as yet to find "fleas" on sewer rats examined after death—caused spontaneously by plague or after killing them by chloroform; lice alone, but these in abundance, have been hitherto found on their dead bodies.

the blood of its former dead companion, died on the third to fourth day with acute plague (just like other rats after cutaneous inoculation), showing hæmorrhagic swollen glands in the groin with dense crowds of B. pestis, the spleen large, dark and firm, crowded with B. pestis; that is to say with the appearances described in detail in last year's report.

This failure of transmission of plague from a plague rat to a healthy rat living amicably in the same or in an adjoining open wire cage is not an isolated instance.* In my reports of 1902–1903 and 1903–1904 I have mentioned a good many such instances; and in the present investigation I have recorded several in addition where only one of two animals (rats, mice) contracted and died of plague, be it by inoculation or by feeding, its companion remaining unaffected though highly susceptible, as proved afterwards by inoculation with active plague material.

While, then, the transmission of plague from animal to animal is experimentally established both as regards cutaneous inoculation and feeding with semi-dry infective material, there is a distinct failure of evidence that transmission of the disease is effected by fleas from an infected animal to a healthy one. It is not therefore, in my view, justifiable to regard this mode of transmission, if indeed it happens at all, under natural conditions, as anything but exceptional, at any rate as far as the sewer rat and the tame white rat are concerned. Theoretically such a transmission is possible and easily imaginable, as I have noted in this and in former reports: It is possible, I mean, that a flea which has just sucked from a rat blood well charged with B. pestis may by biting a neighbouring rat directly inoculate this latter. But what I wish to insist on is that such an occurrence is not likely under natural conditions to be anything but exceptional; there is no direct evidence that this has happened, and in cases where it might have been expected to happen—*e.g.*, in many experiments recorded by me—it certainly did not do so.

* Hitherto I have searched in vain during autumn, winter and spring for fleas on sewer rats and on the tame or white rats. I have been able to discover only lice. I would further point out that as mentioned on a former page the above experiment is not altogether satisfactory since the sewer rat is not an animal with high susceptibility for plague. It is probable that in these respects an important distinction may have to be drawn between this species and the Oriental rat or mus *rattus*. I intend to pay special attention in this connexion to other species of rats occurring in this country, as water rats, ship rats, &c.

No. 2.

APP. B, No. 2.

On the Bacteriological Examination of (1) Deep Well Waters; (2) Upland Waters; and (3) Cow-Dung; by Dr. Houston.

REPORT on the BACTERIOLOGICAL EXAMINATION of (1) DEEP WELL WATERS; (2) UPLAND WATERS; and (3) COW-DUNG; by Dr. A. C. HOUSTON.

Last year (1903–4) I reported on the bacteriology of (1) the Normal Stools of Healthy Persons; (2) the Intestinal Contents of Sea-fowl and Fish; and (3) Certain of our Public Water Supplies.

The following is a brief summary of last year's report (1903–4):—

DIVISION I.

THE NORMAL STOOLS OF HEALTHY PERSONS.

The results were considered under the following headings:—

A. The atypical (non-lactose fermenting) varieties of B. coli in fæces.

B. The cause of the virulence of broth cultures inoculated with minute traces of fæces.

C. Further experiments as regards the indol test.

D. The numerical abundance and biological attributes of streptococci in stools.

E. The vitality of fæcal streptococci.

F. Prospective value of the streptococcus test.

A.—*The atypical (non-lactose fermenting) varieties of B. coli in fæces*

Not much progress, *in a positive sense*, was made in this direction, because out of 257 colonies isolated from 12 stools no less than 251 produced acid and gas in lactose peptone medium.

B.—*The cause of the virulence of broth cultures inoculated with minute traces of fæces.*

During 1902–3 it was found that broth cultures inoculated with minute amounts of human fæces proved highly virulent to rodents, whereas broth cultures of B. coli isolated from parallel amounts of the same material were commonly either non-pathogenic or, at all events, not virulent.

During 1903–4 some experiments were carried out with the object of throwing some light on this problem. On the whole, the results seemed to indicate that the mixed metabolic products of the bacteria may assist in producing the virulent effect observed in rodents consequent on injection of cultures previously sown with minute amounts of fæces, but that the presence of a *mixture* of *living* microbes, *of which at any rate some belong probably to the coli group*, is necessary to ensure the full virulence of such cultures.

C.—*Further experiments as regards the indol test.*

The number of indol producing bacteria per gramme of fæces was found to vary from 10,000 to 10,000 million.

D.—*The Numerical Abundance and Biological Attributes of Streptococci in normal stools.*

Nineteen stools were examined and 300 streptococci were made the subject of special study.

By the use of the salicin, saccharose, lactose, litmus milk, neutral red, raffinose, mannite, and inulin tests, the streptococci were differentiated into 40 groups. The percentage number of the 300 streptococci yielding positive results with each of the foregoing tests, taken in the above order, was as follows:—

92·67; 86·34; 76·34; 61·67; 39·34; 32·00; 24·34; and 4·67 respectively.

E.—*The vitality of fæcal streptococci.*

Out of a total of 125 streptococci, tested (25 in tap water, 100 in saline solution) as regards viability, some perished very rapidly, others less rapidly, others again very slowly, and some were still alive at the close of the experiment.

F.—*Prospective value of streptococcus test.*

Under this heading it was pointed out that streptococci are usually present in enormous numbers in human fæces; that they belong to so many groups that it is conceivable that some of these groups may prove to be specially valuable indicators of fæcal pollution of water; and that some varieties of streptococci certainly die in water very speedily under laboratory conditions of experiment.

DIVISION II.

The Bacteriological Examination of the Intestinal Contents of certain Sea-fowl and of Fish.

Section I.—*The bacteriological examination of the intestinal contents of sea-fowl.*

The results showed that the excreta of gulls contained B. coli in enormous numbers, and also yielded positive results with the streptococcus and B. enteritidis sporogenes tests.

With guillemots, however, the results were negative.

Section II.—*The bacteriological examination of the intestinal contents of sea fish obtained from unpolluted sources.*

In 54 per cent. of the fish experiments the results, as regards the B. coli test, were negative. In 52 per cent. of the experiments atypical microbes were isolated. In 13 per cent. of the cases typical B. coli, on the basis of the tests employed, were isolated from the fish. In the latter instances, either the whole fish or the whole of the alimentary tract had been added to the nutrient medium.

The conclusion was that typical B. coli is either absent or present in small number in the intestines of fish dredged from the sea in localities remote from sewage pollution. Further, that as 54 per cent. of the experiments yielded wholly negative results, it can hardly be the case that even coli-*like* microbes are present naturally in abundance in fish.

SECTION III.—*Various experiments bearing on the ability of fish to infect water with B. coli.*

The experiments were carried out under such variable conditions that they do not lend themselves readily to brief summary. But the results as a whole seemed to show that the presence of fish in water does not tend to create or foster a serious or continuous B. coli infection of such water, nor to render the results of bacterioscopic analysis of such water of doubtful value in relation to the detection of objectionable contamination.

DIVISION III.

RESULTS OF BACTERIOLOGICAL EXAMINATION OF CERTAIN PUBLIC WATER SUPPLIES.

The investigation dealt with the bacteriological analysis of 155 samples of London water after storage and filtration. The results showed that, broadly speaking, about three-quarters of the 155 water samples contained coli-like microbes in either 100 cc., 10 cc., or 1 cc. About one-third of the samples contained "flaginac," *i.e.*, B. coli typical as regards the tests employed either in 100 cc., 10 cc., or 1 cc.

As regards the biological attributes (on the basis of the neutral red, lactose peptone, indol, and litmus milk tests) of the 232 B. coli or coli-like microbes isolated from the several filtered water samples :—

> If feeble response to one or more positive tests be taken into account in the classification, the number of separate groups is 35, and the percentage of "flaginac" B. coli about 31.
>
> If a broader view be taken, and feebly positive results be regarded as completely positive, the number of separate groups is 15, and the percentage of "flaginac" B. coli about 35.

The inquiry clearly showed that the percentage of coli-like microbes showing "weakness of attribute" or "loss of attribute" in the London filtered waters is *far in excess* of what is found on the bacteriological examination of normal human fæces, sewages, sewage effluents, or even certain river waters known to be polluted with sewage.

It was pointed out that storage and filtration of the raw waters effected not only an enormous diminution in the number of intestinal microbes, but also altered likewise the proportion of typical B. coli to atypical coli-like microbes. This altered proportion should not be interpreted merely in a mathematical sense, but as possibly indicating as well intrinsic biological changes in the water during the process of its purification of a kind *tending* to deprive it of any pathogenic qualities it might have possessed originally.

The work carried out during the current year (1904–5) will be considered under three divisions, as under :—

DIVISION I.

The Bacteriological Examination of the Tunbridge Wells Deep Well Waters (31 samples).

DIVISION II.

The Bacteriological Examination of Upland Waters (211 samples).

DIVISION III.

The Bacteriological Examination of fresh Cow-Dung (10 samples).

DIVISION I.

The BACTERIOLOGICAL EXAMINATION of the TUNBRIDGE WELLS DEEP WELL WATERS.

In 1902–3 I undertook at the direction of the Board the examination of the Tunbridge deep well waters (Report of the Medical Officer, Local Government Board, Appendix B., No. 6, 1902–3); an investigation which was a continuation, for purposes of comparison, of earlier work on the bacteriology of certain Chichester shallow well waters carried out during 1900–1–2.

The Tunbridge deep well waters were found to be of great bacteriological purity; and in comparing the results with those obtained in the Chichester inquiry I made remarks to the following effect :—

> The main point of difference brought out by the contrast is as regards B. coli (or allied forms). Of the Chichester waters 90 per cent. contained B. coli, or coli-like microbes, in 100 cc., 80 per cent. in 10 cc., 45 per cent. in 1 cc., and 20 per cent. in 0·1 cc. Whereas of Tunbridge Wells (even when some extremely atypical coli-like microbes were included), 25 per cent. contained these microbes in 100 cc., 6 per cent. in 10 cc., none in 1 cc.

Early in 1903 I had begun a series of experiments with the object of ascertaining whether or not excremental bacteria were absent from relatively *large volumes* (1,000 cc.) of the Tunbridge Wells water. Unfortunately, at this stage, owing to the seasonal rise of the spring water, the pumping operations at the waterworks had to be suspended, thus interrupting this line of investigation. But the two samples that were examined yielded the following results :—

The "gas" and B. enteritidis sporogenes tests yielded negative results even when using for cultural purposes the bacterial contents of 1,000 cc. of water (Pasteur filter brushing method).

As regards the streptococcus test, negative results were obtained in both cases with 100 cc. of water.

In respect of the indol test, one of the two samples gave a positive result with the indol test when using for cultural purposes the bacterial contents of 1,000 cc.

As to B. coli :—One of the two samples contained no B. coli or coli-like microbes in 1,000 cc. The other contained an atypical coli-like microbe in 1,000 cc.

During the current year's work (1904–5) these investigations were, so far as B. coli is concerned, advanced a stage further.

It will be unnecessary for me to enter into any description of the Tunbridge deep well waters, as the matter was considered at length in the report already referred to.

I take this opportunity of again expressing my indebtedness to Mr. William H. Maxwell, Assoc. M. Inst. C.E., Borough and Waterworks Engineer, Tunbridge Wells, for his courteous assistance throughout my investigation.

SUMMARY OF CONTENTS (DIVISION I).

A.—METHODS.

B.—RESULTS OF THE BACTERIOLOGICAL EXAMINATION OF DEEP WELL WATERS.

C.—SUMMARY AND CONCLUSIONS.

A.—METHODS.

B. coli test.

(*a*.) For the 1,000 cc. culture, 1,000 cc. of the water were added to a *large* flask containing 1,000 cc. of sterile double-strength bile-salt glucose peptone medium. The flask was then incubated at 37° C. for four days,* and if during that period no gas formation occurred the result was recorded as negative. When, however, gas formation was observed, secondary plate cultures were made and the microbes studied in pure culture.

(*b*.) Similarly, for the 100 cc. culture, 100 cc. of the water were added to a smaller flask containing 100 cc. of sterile double-strength bile-salt glucose peptone medium. The flask was then incubated at 37° C. for the usual period of two days, the subsequent procedure being as under (*a*).

(*c*.) 10 cc. of water were added to a test tube containing 10 cc. of double-strength bile-salt glucose peptone medium.

(*d*.) 1 cc. of water was added to a test tube containing 10 cc. of ordinary strength bile-salt glucose peptone medium.

(*e*.) 0·1 cc. of water was added to a test tube containing 10 cc. of ordinary strength bile-salt glucose peptone medium.

(*c*), (*d*), (*e*) Incubated at 37° C. for two days.

B. enteritidis sporogenes test.

10 cc., 1 cc., and 0·1 cc. cultures were made in the usual

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* Four days' incubation instead of the usual period of 48 hours owing to the [illegible] of liquid being so large.

B.—Results of the Bacteriological Examination of Deep Well Waters :—

These are set forth in the following table (Table 1, Div. I.) :—

Number. Cols.	Tunbridge Wells Waters. Description of Sample. 1.	B. coli test. 1,000 cc. of water. 2.	B. coli test. 100 cc. of water. 3.	B. coli test. 10 cc. and lesser amounts of water. 4.	B. enteritidis sporogenes test. 10 cc. of sample. 5.
I.	Bore-wells Nos. 1 and 2..	No record	All the samples yielded a negative result.	All the samples yielded a negative result.	All the samples yielded a negative result.
II.	" " " ..	"			
III.	" " " ..	"			
IV.	" " " ..	"			
V.	" " " ..	"			
VI.	" " " ..	"			
VII.	" " " ..	Negative			
VIII.	" " " ..	"			
IX.	" " " ..	"			
X.	" " " ..	"			
XI.	" " " ..	"			
XII.	" " " ..	+(1)*			
XIII.	Bore-well No. 3	Negative			
XIV.	" "	+(2)			
XV.	" "	Negative			
XVI.	" "	"			
XVII.	" "	"			
XVIII.	" "	"			
XIX.	" "	"			
XX.	" "	"			
XXI.	" "	"			
XXII.	" "	+(3)			
XXIII.	" "	+(4)			
XXIV.	" "	Negative			
XXV.	" "	"			
XXVI.	" "	"			
XXVII.	" "	"			
XXVIII.	" "	"			
XXIX.	" "	"			
XXX.	" "	"			
XXXI.	" "	+(5)			

* For the biological characters of microbes (1), (2), (3), (4) and (5), *see* Table 2, Div. I.

C.—Summary and Conclusions.

The facts may be summarised as follows :—

B. enteritidis sporogenes test (Col. 5, Table 1).—None of the samples yielded a positive result when 10 cc. of water were used for cultural purposes. This result, of course, was to be anticipated since I had previously shown that the spores of this anærobe were absent from 100 cc. of the Tunbridge well waters. But it seemed desirable to add in this connexion to the number of the records compiled by me with regard to this test. That sewage usually yields a positive result with $\frac{1}{100}$ to $\frac{1}{1000}$ cc. is now established. The records both as regards water and sewage now comprise some hundreds of samples, and are therefore to be regarded as embodying the results of observations having very wide range indeed.

B. coli test (Cols. 2, 3, 4, Table 1).—None of the 31 samples (100 per cent. negative) contained B. coli or gas-forming coli-like microbes of any kind in 100 cc. of water (Col. 3, Table 1).

As regards the 1000 cc. cultures (Col. 2, Table 1) the results were as follows :—

20 out of 25 samples (80 per cent.) contained no B. coli or gas-forming coli-like microbes of any kind in 1000 cc.; 5 out of 25 samples (20 per cent.) contained B. coli or gas-forming coli-like microbes in 1000 cc.

As to the biological attributes of the B. coli or coli-like microbes which were isolated from the five 1000 cc. cultures yielding positive results (Col. 2, Table 1), the facts are shown in the following table (Table 2, Div. I.) :—

Description. [Compare with Table 1.]	"Gas" in gelatine "shake" cultures. + = positive result.	Cane-sugar peptone cultures.	Fl = fluorescence in neutral red broth cultures.	Ag = Acid and gas in lactose peptone cultures.	In = indol in broth cultures.	Ac = acid and clot in litmus milk cultures.	Classification on a flagellar basis.
Sample XII.—Coli (1) ..	+	0	0	0	0	0	0
Sample XIV.—Coli (2) ..	+	0	fl	0	0	0	fl
Sample XXII.—Coli (3)* ..	+	0	fl	0	0	0	fl
Sample XXIII.—Coli (4) ..	+	acid and gas.	fl	ag	0	ac	flaga
Sample XXXI.—Coli (5) ..	+	0	fl	ag	in	weak clot (ac).	flagin(

* This microbe slowly liquefied gelatine.

With the exception of microbes (4) and (5) all the coli microbes were markedly atypical. Coli (4) failed as re

indol formation; coli (5) was typical except that it showed feeble power to clot milk.

If microbes (1), (2), (3) and (4) be rejected as atypical and microbe (5) accepted as typical B. coli, no less than 24 out of 25 (96 per cent.) of the samples yielded as regards "typical" coli negative results with 1000 cc. while one only out of 25 (4 per cent.) yielded positive results with a like volume of water.

The conclusion is, I think, not unwarrantable that typical B. coli is absent from 1000 cc. of a deep well water drawing its supply from distant and pure sources.

Bringing all my work on these deep well waters together (1902–3–4–5) and regarding coli (5), Sample XXXI., as the only typical B. coli isolated in either year's testing, the following brief summary is of interest: —

None of the 49* samples contained typical B. coli in 100 cc. of water.

26 out of 27† samples contained no typical B. coli in 1000 cc.

From the point of view of comparative bacteriology it may be added that every one of 34 surface samples of *unpolluted sea water*, personally collected on the west coast of Scotland and transmitted to me by Dr. Gordon, yielded negative results, as regards B. coli or coli-like microbes, when 100 cc. of the water were submitted to cultural tests (Page 99, Div. III., Vol. III. Royal Commission on Sewage Disposal).

Further, in reference to the possible significance of the detection of B. coli in water supply, it may be noted that sewage usually contains 100,000 B. coli or coli-like microbes per cc., and an even larger number are present per gramme of human fæces.

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* Sixteen samples in Series I. and two samples in Series II. 1902–3 Report, and 31 samples in present Report.

† Two samples in Series II. 1902–3 Report and 25 samples in present Report.

PP. B, No. 2.

n the
cteriological
camination
(1) Deep
ell Waters;
) Upland
aters; and
) Cow-Dung;
Dr. Houston.

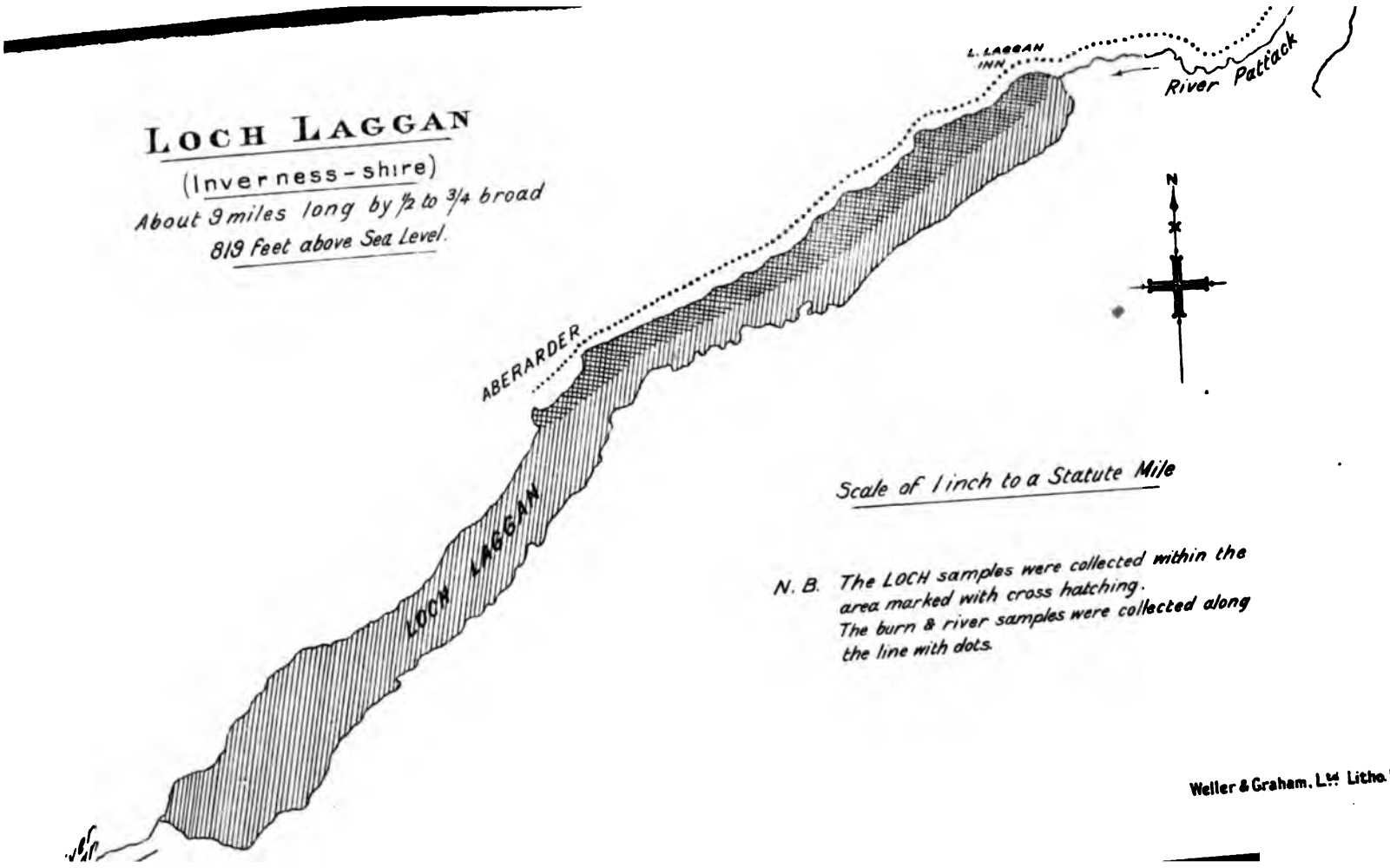
DIVISION II.

The Bacteriological Examination of Upland Waters.

The waters chosen for bacteriological examination were collected from two large, in parts very deep, Highland lochs; Loch Laggan and Loch Ericht. These lochs are situated in mountainous sparsely populated districts. They contain trout in large number and they are liable to some degree of pollution by the excreta of birds, sheep, deer, and other of the lower animals; but detectable sewage contamination is almost absent. Examination was also made of some of the burns and rivers "feeding" one of these lochs (Loch Laggan). As a matter of fact Loch Laggan was, as regards one of its "feeding" streams, not altogether beyond reproach in respect of human excremental pollution, and the river Pattack, which enters the loch at its northern end, has received as well the drainage from manured land. Nevertheless, in relation to all possible sources of pollution whether of human, bird, sheep, cow, horse or deer origin, the volume of water in these two lochs (particularly Loch Ericht) is so enormous that, apart from the question of the influence of fish on the bacterial flora of water, it was to be anticipated that the results of bacteriological tests could not fail to be satisfactory. As regards fish, Loch Laggan undoubtedly contains trout in great abundance, and the same is true of Loch Ericht, although not uncommonly the unlucky angler may think the reverse is true. In this connexion the following extract from the Sportman's and Tourists' Guide (page 252) may be quoted:—

> "We have known two anglers in the same boat kill 120 lbs. in one day. Mr. —— killed, from 6 in the morning till 12 noon, 109 lbs; in 11 casts he landed 27 trout."

Broadly speaking, it may be said that both Lochs, particularly, perhaps, Loch Ericht, contain trout in great number; that Loch Ericht is practically free from sewage pollution, or any other source of contamination, unless from the excreta of birds, sheep, and deer, and possibly some other animals; that Loch Laggan is not altogether above reproach as regards pollution of human origin and the drainage from manured land; but that the volume of water in both lochs is enormous in relation to all external sources of pollution. Upon the whole it may be confidently affirmed that no topographist or epidemiologist, although objecting, particularly in the case of Loch Laggan, to localised sources of pollution, would hesitate to drink the water from either loch elsewhere than in the immediate vicinity of the shore near the point of entrance of some of the "feeding" burns or rivers.


LOCH LAGGAN
(Inverness-shire)
About 9 miles long by 1/2 to 3/4 broad
819 feet above Sea Level.
L. LAGGAN INN
River Pattack
ABERARDER
LOCH LAGGAN
N
Scale of 1 inch to a Statute Mile
N. B. The LOCH samples were collected within the area marked with cross hatching.
The burn & river samples were collected along the line with dots.
Weller & Graham, Ltd Litho. Londo

Summary of Contents (Division II.).

A.—Loch Laggan.

Results of the bacteriological examination of 26 samples of burn and river water (B. coli and B. enteritidis sporogenes tests).

Results of the bacteriological examination of 100 samples of loch water (B. coli and B. enteritidis sporogenes tests).

B.—Loch Ericht.

Results of the bacteriological examination of 100 samples of loch water (B coli and B. enteritidis sporogenes tests).

A.—Loch Laggan (*see* Map).

Loch Laggan is about nine miles long and about half to three-quarters of a mile broad. It is situated in a mountainous and desolate part of Inverness-shire, over 800 feet above sea level. Its precipitous sides are in parts beautifully wooded, and in the adjoining forests are many deer. A large river (River Pattack) enters the loch at its north-eastern end, and many small burns flow into it on both sides. The River Pattack and some of these burns receive the drainage from houses and manured land. Nevertheless in relation to the vast accumulation of water in the loch, which in parts is very deep, the degree of pollution from such sources is certainly not great, and indeed may be considered negligible. Away from the deer forests there are sheep and grouse, and on the lower lying land some cattle and horses. But with the exception of one or two lodges, an inn, and a few cottages, the sources of possible pollution of human origin are practically nil. Like most upland accumulations of water, whether natural or artificial, Loch Laggan is largely dependent on storms and surface water to maintain its supply of water. No doubt during these storms the hill sides and mountain slopes are washed free from impurities of diverse sort, but these pollutions are in the main not of human origin. In the loch are numerous trout and a few salmo-ferox.

Source of the Samples (*see* Map).

The loch samples (85 in number) were collected along the north-west side between Laggan and Aberarder at varying distances from the shore and near the surface. The river and burn samples were collected from the Pattack River, burns flowing into the Pattack, and burns delivering directly into the loch. Many of these samples were collected when the streams were in heavy "spate."

Methods.

The methods followed have been described in previous reports. The quantitative results will be found in Tables 1 and 3, Division II. In these tables figures will be found over the positive signs referring to specimens of B. coli or coli-like microbes isolated from the primary cultures. The biological attributes of these microbes, with corresponding figures, are given in Tables 2 and 4, Division II. The remarks under this heading apply also to the Loch Ericht samples, except, of course, as regards the numbers of the tables.

Results of the Bacteriological Examination of the Burn and River Samples (26 samples). Tables 1 and 2, Division II.

Two of the samples (7·7 per cent.) contained B. coli or coli-like microbes in $\frac{1}{10}$ cc. but not in $\frac{1}{100}$ cc.

Fourteen of the samples (53·8 per cent.) contained B. coli or coli-like microbes in 1 cc. but not in $\frac{1}{10}$ cc.

Nine of the samples (34·6 per cent.) contained B. coli or coli-like microbes in 10 cc. but not in 1 cc.

One of the samples (3·8 per cent.) contained B. coli or coli-like microbes in 100 cc. but not in 10 cc.

The number of B. coli was certainly higher than I had anticipated from the results of my necessarily curtailed topographical observations, which time did not permit to be of an exhaustive character.

TABLE I, DIVISION II.

Showing the results of the bacteriological examination of samples of water collected from some of the burns and rivers entering (directly or indirectly) Loch Laggan.

Cols. 1.	2.	3.	4.	5.	6.	7.
Index Number.	Description of Sample.	Number of B. coli (or coli-like microbes).				
		100 cc. of sample.	10 cc of sample.	1 cc. of sample.	·1 cc. of sample.	·01 cc. of sample.
1	Burns flowing directly into Loch Laggan (N.W. side).	+[15]	+[14]	-		
2	" "	+[17]	+[16]	-		
3	" "	+	+[19]	+[18]	-	
4	" "	+	+[21]	+[20]	-	
5	" "	+	+[23]	+[22]		
6	" "	+	+[51]	+[50]	-	
7	" "	+	+[53]	+[52]	-	
8	" "	+	+[55]	+[54]	-	
9	" "	+[57]	+[56]	-		
10	" "	+	+[59]	+[58]	-	
11	" "	+	+[61]	+[60]	-	
12	" "	+[63]	+[62]	-		
13	" "	+[64]	-			
14	" "	+	+[107]	+[106]	-	
15	" "	+[109]	+[108]	-		
16	" "	+	+[111]	+[110]	-	
17	" "	+[113]	+[112]	-		
18	Pattack River, entering Loch Laggan, N.E. end.	+[31]	+[30]	-		
19	" "	+	+[33]	+[32]	-	
20	Burns flowing into the Pattack River.	+	+[35]	+[34]	-	
21	" "	+	+[37]	+[36]	-	
22	" "	+[39]	+[38]	-		
23	" "	+	+	+[74]	+[73]	-
24	" "	+[76]	+[75]	-		
25	" "	+	+	+[78]	+[77]	-
26	" "	+	+[80]	+[79]	-	

N.B.—The numbers over the positive signs (+) in columns 3, 4, 5, and 6 refer to the specimens of B. coli isolated from the primary cultures. The biological attributes of these microbes are set forth in Table 2, Division II.

1 the
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(1) Deep
all Waters;
Upland
aters; and
Cow-Dung:
Dr. Houston.

All the 26 samples were tested also as regards the B. enteritidis sporogenes test. Three samples (8, 23, and 25) yielded positive, all the rest negative, results when 10 cc. of the water were submitted to culture.

TABLE 2, DIVISION II.

Showing the biological attributes of the B. coli and coli-like microbes isolated from the samples of burn and river water flowing (directly or indirectly) into Loch Laggan.

(*Compare with Table* 1.)

Col. 1.	2.	3.	4.	5.	6.	7.	8.
Index Number.	Reference number, *see* Table 1.	*One-sugar peptone test.* 48 hours at 37° C. *A. G.*=acid and gas. *A. sl. G.*=acid, slight gas.	*Neutral red broth test.* *fl*=fluorescence, 48 hours at 37° C.	*Lactone peptone test.* *ag*=acid and gas, 48 hours at 37° C.	*Indol test.* *in*=indol in broth cultures, 5 days at 37° C.	*Litmus milk test,* *ac*=acid and clot, 5 days at 37° C.	Classification on the "flaginac" basis.
1	14	A. G.	fl	ag	in	ac	flaginac
2	15	A. G.	fl	ag	in	ac	flaginac
3	16	A. sl. G.	fl	ag	in	ac	flaginac
4	17	A. G.	fl	ag	in	ac	flaginac
5	18	0	fl	ag	in	ac	flaginac
6	19	A. G.	fl	ag	in	ac	flaginac
7	20	0	fl	ag	in	ac	flaginac
8	21	0	fl	ag	in	ac	flaginac
9	22	0	fl	ag	in	ac	flaginac
10	23	0	fl	ag	in	ac	flaginac
11	50	0	fl	0	0	0	fl
12	51	A. G.	fl	ag	in	ac	flaginac
13	52	A. sl. G.	fl	ag	in	ac	flaginac
14	53	0	fl	0	0	0	fl
15	54	A. G.	fl	ag	(in)	ac	flag(in)ac
16	55	0	fl	ag	in	ac	flaginac
17	56	A. G.	fl	ag	in	ac	flaginac
18	57	A. G.	fl	ag	in	ac	flaginac
19	58	0	fl	ag	in	ac	flaginac
20	59	0	fl	ag	in	ac	flagina
21	60	0	fl	0	0	0	fl
22	61	0	fl	0	0	0	fl
23	62	0	0	0	0	0	0

TABLE 2—*continued.*

Col. 1.	2.	3.	4.	5.	6.	7.	8.
Index Number.	Reference number. *see* Table 1.	*Cane-sugar peptone test.* 48 hours at 37° C. *A. G.*=acid and gas. *A. sl. G.*=acid, slight Gas.	*Neutral red broth test, fl*=fluorescence, 48 hours at 37° C.	*Lactone peptone test, ag*=acid and gas, 48 hours at 37° C.	*Indol test, in*=indol in broth cultures, 5 days at 37° C.	*Litmus milk test, ac*=acid and clot, 5 days at 37° C.	Classification on the "flaginac basis.
24	63	A. G.	fl	ag	0	ac	flagac
25	64	0	0	0	0	0	0
26	106	0	(fl)	ag	in	ac	(fl)aginac
27	107	A. G.	fl	ag	in	ac	flaginac
28	108	A. G.	fl	ag	0	ac	flagac
29	109	A. G.	fl	ag	0	ac	flagac
30	110	0	fl	0	0	0	fl
31	111	A. G.	fl	ag	in	ac	flaginac
32	112	A. G.	fl	ag	0	0	flag
33	113	A. G.	fl	ag	in	ac	flaginac
34	30	A. G.	fl	ag	in	ac	flaginac
35	31	0	fl	ag	in	ac	flaginac
36	32	0	fl	ag	in	ac	flaginac
37	33	A. G.	fl	ag	in	ac	flaginac
38	24	0	fl	ag	in	0	flagin
39	25	0	fl	ag	in	ac	flaginac
40	26	0	fl	ag	in	ac	flaginac
41	27	0	fl	ag	0	ac	flagac
42	28	A. G.	fl	ag	in	ac	flaginac
43	29	A. sl. G.	fl	ag	in	ac	flaginac
44	73	A. G.	fl	ag	in	ac	flaginac
45	74	0	fl	ag	in	ac	flaginac
46	75	A. G.	fl	ag	in	ac	flaginac
47	76	A. G.	fl	ag	in	ac	flaginac
48	77	A. G.	fl	ag	in	ac	flaginac
49	78	0	fl	ag	in	ac	flaginac
50	79	A. G.	fl	ag	in	ac	flaginac
51	80	A. G.	fl	ag	in	ac	flaginac

N.B.—The figures in column 2 correspond to those over the positive signs (+) in columns 3, 4, 5, and 6 of Table 1, Division II.

All the foregoing microbes gave "gas" in gelatine shake cultures.

None of the microbes liquefied gelatine (30 days at 20° C.).

As regards the biological attributes of the B. coli or coli-like microbes associated with the foregoing positive results, reference must be made to Table 2, Division II.

Out of 51 specimens no less than 36 (70 per cent.) were found to be flaginac B. coli. It will presently be shown that the percentage number of flaginac B. coli in the Loch Laggan samples was even higher, and the discussion of these results may be left to a later stage.

Results of the Bacteriological Examination of Loch Laggan Samples (85 samples). Tables 3 and 4, Division II.

As might perhaps have been anticipated, the loch samples yielded better results than the burns or rivers "feeding" the loch. Nevertheless, the difference was not so marked as might have been anticipated in view of the enormous volume of water in the loch.

One sample (1·17 per cent.) contained B. coli or coli-like microbes in 1 cc. but not in $\frac{1}{10}$ cc.

Twenty-eight samples (33 per cent.) contained B. coli or coli-like microbes in 10 cc. but not in 1 cc.

Forty-two samples (49·4 per cent.) contained B. coli or coli-like microbes in 100 cc. but not in 10 cc.

Fourteen samples (16·4 per cent.) contained no B. coli or coli-like microbes even in 100 cc.

Approximately, one-third and one-half of the samples contained B. coli or coli-like microbes in 10 cc. and 100 cc. respectively, and one-sixth of the samples contained no coli-like microbes of any kind in 100 cc.

TABLE 3, DIVISION II.

Showing the results of the bacteriological examination of samples of water collected from Loch Laggan.

Cols. 1.	2.	3.	4.	5.	6.	7.
Index Number.	Description of Sample.	Number of B. coli (or coli-like microbes).				
		100 cc. of sample.	10 cc. of sample.	1 cc. of sample.	·1 cc. of sample.	·01 cc. of sample.
1	Loch Laggan, north-west side.	+ [2]	+ [1]	-		
2	" "	+ [3]	-			
3	" "	+ [5]	+ [4]	-		
4	" "	-				
5	" "	+ [7]	+ [6]	-		
6	" "	+ [9]	+ [8]	-		
7	" "	+ [1]	-			
8	" "	+ [11]	-			
9	" "	-				
10	" "	+ [13]	-			
11	" "	+ [24]	-			
12	" "	+ [25]	-			
13	" "	+ [26]	-			
14	" "	+ [27]	-			
15	" "	-				
16	" "	+ [28]	-			
17	" "	-				
18	" "	-				
19	" "	+ [41]	-			
20	" "	+ [42]	-			
21	" "	-				
22	" "	+ [43]	-			
23	" "	+ [44]	-			
24	" "	+ [45]	-			
25	" "	-				
26	" "	+ [46]	-			
27	" "	+ [48]	-			
28	" "	-				
29	" "	-				
30	" "	+ [66]	+ [65]	-		
31	" "	+ [6]	+ [67]	-		
32	" "	+ [70]	+ [69]	-		
33	" "	+ [71]	-			

On the Bacteriological Examination of (1) Deep Well Waters; (2) Upland Waters; and (3) Cow-Dung; by Dr. Houston.

TABLE 3—*continued.*

Cols. 1.	2.	3.	4.	5.	6.	7.
Index Number.	Description of Sample.	Number of B. coli (or coli-like microbes).				
		100 cc. of sample.	10 cc. of sample.	1 cc. of sample.	·1 cc. of sample.	·01 cc. of sample.
34	Loch Laggan, north-west side.	+[81]	−			
35	" "	+[82]	−			
36	" "	+[83]	−			
37	" "	+[84]	−			
38	" "	+[86]	+[85]	−		
39	" "	+[88]	+[87]	−		
40	" "	+[90]	+[89]	−		
41	" "	+[91]	−			
42	" "	−				
43	" "	+[93]	+[92]	−		
44	" "	−				
45	" "	+[95]	+[94]	−		
46	" "	+[97]	+[96]	−		
47	" "	+[99]	+[98]	−		
48	" "	+	+[101]	+[100]	−	
49	" "	+[102]	−			
50	" "	+[104]	+[103]	−		
51	" "	−				
52	" "	+[114]	−			
53	" "	+[115]	−			
54	" "	+[116]	−			
55	" "	+[118]	+[117]	−		
56	" "	+[119]	−			
57	" "	+[120]	−			
58	" "	+[123]	+[121]	−		
59	" "	+[124]	+[125]	−		
60	" "	+[126]	−			
61	" "	+[128]	−			
62	" "	−	−			
63	" "	+[127]	−			
64	" "	+[129]	−			
65	" "	+[130]	+[129]	−		
66	" "	+[132]	+[131]	−		
67	" "	+[134]	+[133]	−		
68	" "	+[135]	−			

TABLE 3—*continued.*

Cols. 1.	2.	3.	4.	5.	6.	7.
Index Number.	Description of Sample.	Number of B. coli (or coli-like microbes).				
		100 cc. of sample.	10 cc. of sample.	1 cc. of sample.	·1 cc. of sample.	·01 cc. of sample.
69	Loch Laggan, north-west side.	+[136]	-			
70	" "	+[138]	+[137]	-		
71	" "	+[140]	+[139]	-		
72	" "	+[142]	+[141]	-		
73	" "	+[143]	-			
74	" "	+[144]	-			
75	" "	+[146]	+[145]	-		
76	" "	+[147]	-			
77	" "	+[149]	+[148]	-		
78	" "	+[150]	-			
79	" "	+[151]	-			
80	" "	+[152]	-			
81	" "	+[154]	+[18]	-		
82	" "	-				
83	" "	+[156]	+[155]	-		
84	" "	+[157]	-			
85	" "	+[158]	-			

N.B.—The numbers over the positive signs (+) in columns 3, 4, and 5 refer to the specimens of B. coli isolated from the primary cultures. The biological attributes of these microbes are set forth in Table 4, Division II.

All the 85 Loch Laggan samples were tested also as regards B. enteritidis sporogenes. Four samples (?11, ?41, 43 and 47) yielded with 10 cc. positive or doubtfully negative results; none of the remaining samples yielded positive results when 10 cc. of the water were submitted to culture.

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(1) Deep
ell Waters;
) Upland
aters; and
) Cow-Dung;
Dr. Houston.

TABLE 4, DIVISION II.

Showing the Biological Attributes of the B. coli isolated from the samples of Water from Loch Laggan. (Compare with Table 3.)

Col. 1.	2.	3.	4.	5.	6.	7.	8.
Index Number.	Reference number, *see* Table 3.	*Cane-sugar peptone test.* 48 hours at 37° C. A. G.=acid and gas. A. sl. G.=acid slight gas.	*Neutral red broth test.* fl=fluorescence, 48 hours at 37° C.	*Lactose peptone test.* ag=acid and gas, 48 hours at 37° C.	*Indol test.* in=indol in broth culture, 5 days at 37° C.	*Litmus milk test.* ac=acid and clot, 5 days at 37° C.	Classification on the "flaginac" basis.
1	1	A. G.	fl	ag	in	ac	flaginac
2	2	A. G.	fl	ag	in	ac	flaginac
3	3	0	fl	ag	0	0	flag
4	4	A. sl. G.	fl	ag	in	ac	flaginac
5	5	A. sl. G.	fl	ag	in	ac	flaginac
6	6	0	fl	ag	in	ac	flaginac
7	7	A. G.	fl	ag	in	ac	flaginac
8	8	A. sl. G.	fl	ag	in	ac	flaginac
9	9	A. sl. G.	fl	ag	in	ac	flaginac
10	10	A. sl. G.	fl	ag	in	ac	flaginac
11	11	A. sl. G.	fl	ag	in	ac	flaginac
12	12	A. sl. G.	fl	ag	in	ac	flaginac
13	34	A. sl. G.	fl	ag	in	ac	flaginac
14	35	A. G.	fl	ag	in	0	flagin
15	36	A. G.	fl	ag	in	ac	flaginac
16	37	0	fl	ag	in	0	flagin
17	38	A. sl. G.	fl	ag	in	ac	flaginac
18	41	A. G.	fl	ag	in	ac	flaginac
19	42	0	fl	ag	in	ac	flaginac
20	43	A. G.	fl	ag	in	ac	flaginac
21	44	A. sl. G.	fl	ag	in	ac	flaginac
22	45	0	fl	ag	in	ac	flaginac
23	46	A. G.	fl	ag	in	ac	flaginac
24	48	A. G.	fl	ag	in	ac	flaginac
25	65	A. G.	fl	ag	in	ac	flaginac
26	66	A. G.	fl	ag	in	ac	flaginac
27	67	0	fl	ag	in	ac	flaginac
28	68	0	fl	ag	in	ac	flaginac
29	69	0	fl	ag	in	ac	flaginac

TABLE 4—*continued.*

Col. 1.	2.	3.	4.	5.	6.	7.	8.
Index Number.	Reference number, *see* Table 3.	*Cane-sugar peptone test.* 48 hours at 37° C. A. G.=acid and gas. A. sl. G.=acid slight gas.	*Neutral red broth test.* fl=fluorescence, 48 hours at 37° C.	*Lactose peptone test.* ag=acid and gas, 48 hours at 37° C.	*Indol test.* in=indol in broth culture, 5 days at 37° C.	*Litmus milk test.* ac=acid and clot, 5 days at 37° C.	Classification on the "flaginac" basis.
30	70	A. G.	fl	ag	in	ac	flaginac
31	71	A. G.	fl	ag	in	ac	flaginac
32	81	A. G.	fl	ag	in	ac	flaginac
33	82	A. sl. G.	fl	ag	0	ac	flagac
34	83	A. sl. G.	fl	ag	in	ac	flaginac
35	84	A. G.	fl	ag	in	ac	flaginac
36	85	A. G.	fl	ag	in	ac	flaginac
37	86	A. sl. G.	fl	ag	in	ac	flaginac
38	87	0	0	0	0	0	0
39	88	A. G.	fl	ag	in	ac	flaginac
40	89	A. G.	fl	ag	in	ac	flaginac
41	90	A. G.	fl	ag	in	ac	flaginac
42	91	0	fl	ag	in	ac	flaginac
43	92	0	fl	0	0	0	fl
44	93	A G.	fl	ag	in	ac	flaginac
45	94	0	fl	0	in	0	flin
46	95	A. G.	fl	ag	in	0	flagin
47	96	0	fl	0	in	0	flin
48	97	A. G.	fl	ag	in	ac	flaginac
49	98	0	fl	ag	in	ac	flaginac
50	99	A. G.	fl	ag	in	ac	flaginac
51	100	A. G.	fl	ag	in	ac	flaginac
52	101	0	fl	ag	in	ac	flaginac
53	103	A. G.	fl	ag	in	ac	flaginac
54	103	A. G.	fl	ag	in	ac	flaginac
55	104	A. G.	fl	ag	in	0	flagin
56	114	0	fl	ag	in	ac	flaginac
57	115	A. G.	fl	ag	in	ac	flaginac
58	116	0	fl	ag	in	ac	flaginac
59	117	0	fl	ag	in	ac	flaginac
60	118	A. G.	fl	ag	in	ac	flaginac
61	119	A. G.	fl	ag	in	ac	flaginac

TABLE 4—*continued.*

Col. 1.	2.	3.	4.	5.	6.	7.	8.
Index Number.	Reference number see Table 3.	*Cane-sugar peptone test.* 48 hours at 37° C. A. G.=acid and gas. A. sl. G.=acid slight gas.	*Neutral red broth test.* fl=fluorescence, 48 hours at 37° C.	*Lactose peptone test.* ag=acid and gas, 48 hours at 37° C.	*Indol test.* in=indol in broth culture, 5 days at 37° C.	*Litmus milk test.* ac=acid and clot, 5 days at 37° C.	Classification on the "flaginac" basis.
62	120	A. G.	fl	0	in	ac	flinac
63	121	0	fl	0	0	0	fl
64	122	A. G.	fl	ag	in	ac	flaginac
65	123	0	fl	ag	in	ac	flaginac
66	124	A. sl. G.	fl	ag	in	ac	flaginac
67	125	0	fl	ag	in	ac	flaginac
68	126	0	fl	ag	in	ac	flaginac
69	127	A. G.	fl	ag	in	ac	flaginac
70	128	A. G.	fl	ag	in	ac	flaginac
71	129	0	fl	0	0	0	fl
72	130	A. G.	fl	ag	in	ac	flaginac
73	131	0	fl	ag	in	ac	flaginac
74	132	A. G.	fl	0	in	ac	flinac
75	133	A. sl. G.	fl	ag	in	ac	flaginac
76	134	0	fl	ag	in	ac	flaginac
77	135	A. G.	fl	ag	in	ac	flaginac
78	136	A. sl. G.	fl	ag	in	ac	flaginac
79	137	A. G.	fl	ag	in	ac	flaginac
80	138	0	(fl)	ag	in	ac	(fl)aginac
81	139	A. G.	fl	ag	in	ac	flaginac
82	140	0	0	ag	in	ac	aginac
83	141	0	fl	0	0	0	fl
84	142	A. G.	fl	ag	in	ac	flaginac
85	143	A. G.	fl	ag	in	ac	flaginac
86	144	A. G.	fl	ag	in	ac	flaginac
87	145	A. sl. G.	fl	ag	in	ac	flaginac
88	146	A. G.	fl	ag	in	ac	flaginac
89	147	0	fl	ag	in	ac	flaginac
90	148	A. G.	fl	ag	in	ac	flaginac
91	149	0	fl	ag	in	ac	flaginac
92	150	0	fl	ag	in	ac	flaginac
93	151	0	fl	ag	in	ac	flaginac

TABLE 4—*continued.*

Col. 1.	2.	3.	4.	5.	6.	7.	8.
Index Number.	Reference number, *see* Table 3.	*Cane-sugar peptone test.* 48 hours at 37° C. A. G.=acid and gas. A. sl. G.=acid slight gas.	*Neutral red broth test.* fl=fluorescence, 48 hours at 37° C.	*Lactose peptone test.* ag=acid and gas, 48 hours at 37° C.	*Indol test.* in=indol in broth culture, 5 days at 37° C.	*Litmus milk test.* ac=acid and clot, 5 days at 37° C.	Classification on the "flaginac" basis.
94	152	0	fl	ag	in	ac	flaginac
95	153	A. G.	fl	0	0	ac	flac
96	154	A. G.	fl	ag	in	ac	flaginac
97	155	A. G.	fl	ag	in	ac	flaginac
98	156	0	fl	ag	in	ac	flaginac
99	157	A. sl. G.	fl	ag	in	ac	flaginac
100	158	A. G.	fl	ag	in	ac	flaginac

N.B.—The figures in column 2 correspond to those over the positive signs (+) in columns 3, 4, and 5 of Table 3.

All the microbes gave "gas" in gelatine "shake" cultures, and 82 per cent. of them were flaginac B. coli. With the exception of No. 95 (153) none of the microbes liquefied gelatine (30 days at 20° C.).

These Loch Laggan results may be compared with those previously given as regards burn and river samples, as follows:—

B. coli test.

——	+·1 cc. (5th class.)	+1 cc. (4th class.)	+10 cc. (3rd class.)	+100 cc. (2nd class.)	−100 c.c. (1st class.)
Burn and river samples	7·7%	53·8%	34·6%	3·8%	—
Loch Laggan samples	—	1·17%	33%	49·4%	16·4%

It is clear that the Loch Laggan samples were considerably purer bacteriologically than the burn and river samples. But assuming that the bacteriological condition of the "feeding" streams explains sufficiently the presence of a few B. coli in the loch samples, it was to be anticipated that, if B. coli died very rapidly in pure water, the presence of this microbe in the loch samples would, in view of the enormous volume of water stored in the loch, have been demonstrable even less often than proved to be the case.

The somewhat unexpected results which I have noted do not, however, suggest that trout are able to contaminate pure water with B. coli to any great extent, if at all. For notwithstanding the fact that 96 per cent. of the burn and river samples contained B. coli in 10 cc. or less of the water, 65·8 per cent. of the loch samples contained no B. coli in 10 cc. of the water. Indeed, despite the presence of numerous trout and the continual ingress to the loch of water containing an appreciable number of B. coli, a tendency would seem indicated of B. coli to die in pure water under natural conditions of storage.

Although the possibility or probability of contamination in some degree by sewage could not be altogether eliminated in this case, I think that the B. coli found in the river, burn, and loch samples were largely not of human origin, but were derived from the drainage of manured land and the excreta of birds and the lower animals.

From this point of view the results obtained indicate the danger of too stringent standards and the necessity of interpreting the bacteriological results in relation to the local surroundings.

Dealing with the facts, *irrespective of topographical observations*, I should, on a provisional standard adopted by me, have classed* these waters as follows :—

Class.	Quantitative results: B. coli test.	Burn and river samples.	Loch samples.
1st	−100 cc. — A water showing no evidence (bacteriologically) of recent objectionable contamination, and therefore, in the absence of conditions of an actually or potentially dangerous kind, seemingly "safe" for domestic use.	None	16·4%
2nd	+100 cc., −10 cc. — A water showing appreciable evidence (bacteriologically) of presumably objectionable contamination, and therefore not absolutely free from the suggestion of being potentially, if to an almost negligible extent, dangerous to health.	3·8%	49·4%
3rd	+10 cc., −1 cc. — A water showing definite evidence (bacteriologically) of contamination presumably objectionable in character, and therefore to be regarded with some suspicion.	34·6%	33%
4th	+1 cc., −·1 cc.—A water showing such obvious indications (bacteriologically) of pollution, presumably objectionable in character, as hardly to fall within the category of water reasonably safe for potable purposes *in the absence of contra-indications of a convincing kind.*	53·8%	1·17%
5th	+·1 cc., −·01 cc.—A water showing such clear evidence (bacteriologically) of presumably objectionable contamination as to be quite unfit for domestic use, *on the basis of this test.*	7·7%	None

Thus, had the samples been sent to me without any indication as to their sources I should, *on the above basis and so far as the actual quantitative B. coli results are concerned,*

* Report of the Medical Officer, Local Government Board, Appendix B, No. 5, page 559.

have condemned provisionally 61·5 per cent. of the burn and river samples and 1·17 per cent. of the Loch Laggan samples.

As regards the biological attributes of the B. coli or coli-like microbes isolated from the Loch Laggan samples reference must be made to Table 4.

Out of 100 specimens of B. coli or coli-like microbes no less than 82 per cent. were flaginac B. coli. This is a very high percentage, and it is difficult to explain why the burn and river and also the loch samples contained so many typical B. coli—namely, 70 per cent. and 80 per cent. respectively. But this is by no means the first time I have met with difficulties of this sort. For example, in examining the waters of the Helford and Penryn estuarial rivers, it was found that the former was topographically satisfactory and the latter obviously, although not grossly, sewage polluted.* Although 84 per cent. of the Penryn samples contained B. coli in 1 cc. or less of the water and only 32 per cent. of the Helford samples contained B. coli in 1 cc., the percentage number of flaginac B. coli was the same in each case—namely, about 65 per cent.

In the particular case of Loch Laggan, and its "feeding" streams, I am inclined to attribute the results obtained to pollution of an otherwise pure water with *recent* excremental matters in amount easily detected on bacteriological analysis, but not sufficing to increase appreciably the amount of assimilable pabulum in the water.

In the case of a grossly polluted river containing much organic matter derived not only from sewage but other sources of organic contamination as well, it is conceivable that the conditions might be more favourable for the persistence of non-flaginac than flaginac B. coli.

Thus, a loch water chemically pure but slightly impure bacteriologically might yield few B. coli, but most of them typical, whereas a river water impure both chemically and bacteriologically might yield many B. coli but fewer (proportionately) of them typical in character.

Possibly in the case of the Loch Laggan water the majority of the B. coli were typical initially and were continually dying in this relatively pure water and continually being replenished, and that in this way the ratio of typical to atypical microbes was maintained in this water at a fairly constant figure.

Possibly in the case of the "feeders" of the loch no inconsiderable number of the total B. coli entering the river are atypical to start with, and that as a consequence of the impure condition of the river water these atypical B. coli were fostered to a greater extent than the typical B. coli, with the result of increase in the *proportion* of non-flaginac B. coli.

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* Royal Commission on Sewage Disposal, Vol. III., Division IV., page 114 *et seq.*

With reference to the observation that the ratio of flaginac B. coli to atypical coli was somewhat greater in the loch than in the burn and river samples, the fact—unless the difference was merely accidental—would seem to indicate that flaginac B. coli can live longer in pure loch water than non-flaginac B. coli.

Before leaving this subject, however, it ought to be pointed out that, despite the high percentage of flaginac B. coli, the proportion of cane-sugar fermenting microbes was considerable. This is a circumstance which, I think, militates somewhat against acceptance of all these flaginac B. coli as being of recent excremental origin. At all events, in fresh human fæces my observations have been as follows:—Only 8 per cent. distinctly positive; 22 per cent. feebly positive; 36 per cent. practically negative; 35 per cent. negative. The Loch Laggan results were:—As many as 48 per cent. distinctly positive; 18 per cent. feebly positive; and 34 per cent. negative.

Finally as regards the B. enteritidis sporogenes test, the burn and river and loch samples yielded the following results.

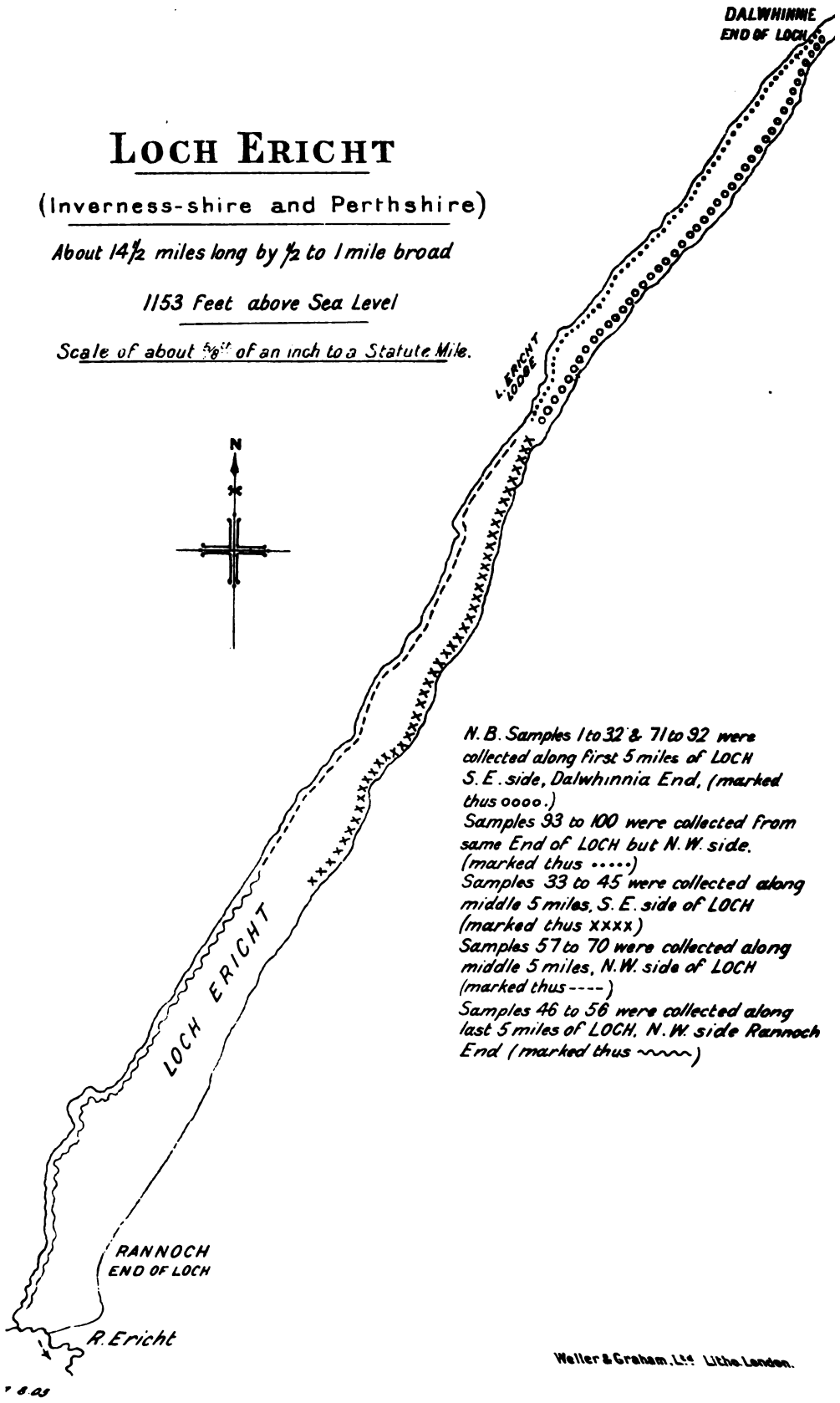
Eighty-one out of 85 of the Loch Laggan samples contained no spores of B. enteritidis sporogenes in 10 cc. of water. Of the remaining four samples, two yielded a doubtfully positive and two a positive result with 10 cc. but not with 1 cc. of the water.

Twenty-three out of 26 of the burn and river samples contained no spores of B. enteritidis sporogenes in 10 cc. of water. Three samples yielded positive results with 10 cc. but not with 1 cc. of the sample.

Taking these enteritidis results together and accepting the doubtfully positive results as completely positive, only seven out of 111 samples (6·3 per cent.) yielded positive results when using 10 cc. of water for cultural purposes. None of the samples yielded a positive result with 1 cc. of the water. These results do not support the proposition that the spores of this anaerobe are ubiquitous. Sewage commonly yields a positive result with ·01 to ·001 cc. (100 to 1,000 per cc.).

B.—Loch Ericht (*see* Map).

Loch Ericht is about 15 miles long and about half to one mile broad. It is situated partly in Inverness-shire and partly in Perthshire, over 1,000 feet above sea level, in a mountainous and sparsely populated district. The shores are beautifully wooded in parts and the forests contain many deer. On either side of the loch the hills rise to a great height. The loch is very deep and is said never to freeze. With the exception of a Lodge and a few cottages there are seemingly no sources of pollution of human origin on its watershed. The sole sources of excremental pollution would appear to be from birds and the lower animals (*e.g.*, deer). During rainy weather a great number of small burns,



LOCH ERICHT

(Inverness-shire and Perthshire)

About 14½ miles long by ½ to 1 mile broad

1153 Feet above Sea Level

Scale of about 5/8" of an inch to a Statute Mile.

N.B. Samples 1 to 32 & 71 to 92 were collected along first 5 miles of LOCH S.E. side, Dalwhinnia End, (marked thus oooo.)
Samples 93 to 100 were collected from same End of LOCH but N.W. side. (marked thus ••••)
Samples 33 to 45 were collected along middle 5 miles, S.E. side of LOCH (marked thus xxxx)
Samples 57 to 70 were collected along middle 5 miles, N.W. side of LOCH (marked thus ----)
Samples 46 to 56 were collected along last 5 miles of LOCH, N.W. side Rannoch End (marked thus ~~~~)

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which in dry weather cease to run, feed the loch on either side with surface water. But the water in Loch Ericht is surprisingly cold even in very hot weather; a fact which is probably due not only to its great depth but also to the presence in it of much spring water.

Source of the Samples (*see* Map).

The samples (100 in number) were collected about 50 yards from the shore and near the surface of the loch. Nos. 1 to 32 and 71 to 92 were collected along the first five miles of the loch (Dalwhinnie end), on the S.E. side. Samples 93 to 100 were collected from the same end of the loch but on the opposite side. Samples 33 to 45 were collected along the middle five miles on the S.E. side, and samples 57 to 70 on the opposite side. Lastly, samples 46 to 56 were collected along the last five miles of the loch (Rannoch end), on the N.W. side.

Results of the Bacteriological Examination of the Loch Ericht samples of water (100 samples). Tables 5 and 6, Division II.

One of the samples (1 per cent.) contained B. coli or coli-like microbes in 10 cc. but not in 1 cc.

Nineteen of the samples (19 per cent.) contained B. coli or coli-like microbes in 100 cc. but not in 10 cc.

Eighty of the samples (80 per cent.) contained no B. coli or coli-like microbes, even in 100 cc. of water.

Thus the water was remarkably pure; 80 per cent., 19 per cent., and 1 per cent. of the samples coming under the 1st, 2nd, and 3rd classes respectively as regards the B. coli test. These results may be compared with those already given under Loch Laggan, as follows:—

B. coli test.

—	4th class, + 1 cc.	3rd class, + 10 cc.	2nd class, + 100 cc.	1st class, — 100 cc.
	Per cent.	Per cent.	Per cent.	Per cent.
Loch Loggan samples ...	1·17	33·0	49·4	16·4
Loch Ericht samples ...	—	1·0	19·0	80·0

Accordingly, by this test, the Loch Ericht samples were much purer than the Loch Laggan samples.

[illegible] the biological attributes of the B. coli or coli-like [illegible] isolated from the Loch Ericht samples, the results are [illegible] Table 6, Division II. Only 6 out of 21 specimens [illegible] were faginac B. coli; this is in marked contra- [illegible] the Loch Laggan results. Experiment has proved [illegible] pure samples of water may contain, on occasion and in [illegible] number, coli-like microbes, but seldom typical B. coli; [illegible] moderately pure waters may contain few B. coli, but that [illegible] a majority of these may be found to be typical B. coli; [illegible] grossly polluted waters may contain coli-like microbes [illegible] abundance, but that a considerable proportion of these may be [illegible] in character.

TABLE 5. DIVISION II.

Showing the results of the bacteriological examination of water collected from Loch Ericht.

[illegible] Number.	2. Description of Sample.	3. Number of B. coli (or coli-like microbes). 100 cc. of sample.	4. 10 cc. of sample.	5. 1 cc. of sample.
[illegible]	Loch Ericht, collected about 50 yards from shore along first five miles from Dalwhinnie end of loch, S.E. side.	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		
[illegible]	" " "	-		

TABLE 5—*continued.*

Cols. 1.	2.	3.	4.	5.
Index Number.	Description of Sample.	Number of B. coli (or coli-like microbes).		
		100 cc. of sample.	10 cc. of sample.	1 cc. of sample.
18	Loch Ericht, collected about 50 yards from shore along first five miles from Dalwhinnie end of loch, S.E. side.	-		
19	" " "	-		
20	" " "	-		
21	" " "	+[1]	-	
22	" " "	-		
23	" " "	-		
24	" " "	-		
25	" " "	+	-	
26	" " "	+[2]	-	
27	" " "	-		
28	" " "	-		
29	" " "	-		
30	" " "	-		
31	" " "	-		
32	" " "	-		
33	Loch Ericht, collected about 50 yards from shore along middle five miles, S.E. side.	-		
34	" " "	-		
35	" " "	-		
36	" " "	-		
37	" " "	-		
38	" " "	+[4]	-	
39	" " "	-		
40	" " "	-		
41	" " "	-		
42	" " "	-		
43	" " "	-		
44	" " "	+[5]	-	
45	" " "	-		
46	Loch Ericht, collected about 50 yards from shore, last five miles Rannoch end of loch, N.W. side.	-		
47	" " "	-		
48	" " "	-		
49	" " "	+[6]	-	

on the bacteriological examination of (1) Deep Well Waters; (2) Upland Waters; and (3) Cow-Dung; by Dr. Houston.

TABLE 5—*continued.*

Cols. 1.	2.	3.	4.	5.
Index Number.	Description of Sample.	Number of B. coli (or coli-like microbes).		
		100 cc. of sample.	10 cc. of sample.	1 cc. of sample.
50	Loch Ericht, collected about 50 yards from shore, last five miles Rannoch end of loch, N.W. side.	+[7]	-	
51	" " "	-		
52	" " "	-		
53	" " "	-		
54	" " "	-		
55	" " "	+[8]	-	
56	" " "	+[9]	-	
57	Loch Ericht, collected about 50 yards from shore along middle five miles, N.W. side.	-		
58	" " "	-		
59	" " "	+[10]	-	
60	" " "	-		
61	" " "	+[11]	-	
62	" " "	-		
63	" " "	-		
64	" " "	-		
65	" " "	-		
66	" " "	+[12]	-	
67	" " "	+[13]	-	
68	" " "	-		
69	" " "	-		
70	" " "	-		
71	Loch Ericht, collected about 50 yards from shore along first five miles from Dalwhinnie end of loch, S.E. side.	-		
72	" " "	-		
73	" " "	-		
74	" " "	-		
75	" " "	-		
76	" " "	-		
77	" " "	+[14]	-	
78	" " "	+[15]	-	
79	" " "	-		
80	" " "	-		
81	" " "	-		

TABLE 5—*continued.*

Cols. 1.	2.	3.	4.	5.
Index Number.	Description of Sample.	Number of B. coli (or coli-like microbes).		
		100 cc. of sample.	10 cc. of sample.	1 cc. of sample.
82	Loch Ericht, collected about 50 yards from shore along first five miles from Dalwhinnie end of loch, S.E. side.	-		
83	" " "	-		
84	" " "	+[18]	-	
85	" " "	-		
86	" " "	-		
87	" " "	-		
88	" " "	-		
89	" " "	-		
90	" " "	+[17]	-	
91	" " "	-		
92	" " "	-		
93	Loch Ericht, collected about 50 yards from shore first five miles from Dalwhinnie end of loch, N.W. side.	-		
94	" " "	-		
95	" " "	-		
96	" " "	+[18]	-	
97	" " "	-		
98	" " "	-		
99	" " "	+[20]	+[19]	-
100	" " "	+[21]	-	

N.B.—The numbers over the positive signs (+) in columns 3 and 4 refer to the specimens of B. coli isolated from the primary cultures. The biological attributes of these microbes are set forth in Table 6, Division II.

All these 100 samples were tested also as regards the B. enteritidis sporogenes test. One sample (No. 79) yielded a positive result with 10 cc. of the sample, and all the rest a negative result when 10 cc. of the water were submitted to culture.

Cols. 1.

Index Number.

SION II.

...es of the B. coli or coli-like
...ples of water collected from

...ch Table 5.)

	5.	6.	7.	8.
	Lactose peptone test. ag=acid and gas, 48 hours at 37° C.	*Indol test.* in=indol in broth cultures, 6 days at 37° C.	*Litmus milk test.* ac=acid and clot, 6 days at 37° C.	Classification on the "flaginac" basis.
1	0	0	0	fl
1	0	0	0	fl
1	ag	in	ac	flaginac
1	ag	0	0	flag
1	ag	in	ac	flaginac
1	ag	in	ac	flaginac
1	0	0	ac	flac
1	0	0	0	fl
1	ag	0	ac	flagac
1	0	0	(ac)	fl(ac)
1	0	0	0	fl
1	0	0	0	fl
1	0	0	(ac)	fl(ac)
1	ag	in	ac	flaginac
1	ag	in	ac	flaginac
1	ag	0	ac	flagac
1	ag	0	ac	flagac
1	(ag)	0	0	fl(ag)
1	(ag)	0	ac	fl(ag)ac
1	(ag)	0	ac	fl(ag)ac
1	ag	in	ac	flaginac

... in column 2 correspond to those over the
...) in columns 3 and 4 of Table 5. All the
... "gas" in gelatine "shake" cultures. Microbes
... 16, 19, and 20 slowly liquefied gelatine.

The question of the ability of fish to infect water with B. coli has been frequently raised, and it has been suggested that if fish can infect water in this way the B. coli test may be of small value as a means of indicating the purity or otherwise of water. This contention was dealt with, although from a different standpoint, in last year's report, and the results seemed to show that the presence of fish in water is not likely to create or foster a serious or continuous B. coli infection of such waters, or to render the results of their bacterioscopic analysis of doubtful value in relation to the detection of objectionable contamination.

As regards the present inquiry, it is preferable to base conclusions on the Loch Ericht results, because in this loch all external sources of animal pollution were at a minimum, whereas in the case of Loch Laggan the river Pattack and some of the "feeding" burns were certainly polluted or liable to pollution. Moreover, of the two lochs I think Loch Ericht contains the most trout (*see* quotation, already given).

Experiment has demonstrated that 80 per cent. of the samples of Loch Ericht water contained no B. coli or coli-like microbes of any kind in 100 cc. If two anglers could on occasion catch 120 lbs. of fish in one day, and another angler 109 lbs. in six hours in this loch, it cannot be maintained that the presence of numerous trout need produce any marked or indeed appreciable influence as regards the practical utility of the B. coli test. In shallow polluted waters containing much organic matter the case may be different, but such waters would probably be considered unfit for drinking purposes. The question, from the practical point of view, may be narrowed down to the following:—Given a water relatively free from external sources of undesirable pollution, would the sustained existence in such water of fish be likely to cause the water to contain such proportion of B. coli as might lead the bacteriologist to pronounce, judging by the results of analysis, an unfavourable judgment? So far as my Loch Ericht results go the answer is in the negative.

DIVISION III.

THE BACTERIOLOGICAL EXAMINATION OF FRESH COW-DUNG.

The bacteriology of cow-dung is of particular interest for two reasons.

In the first place, cow-dung is one of the commonest sources of the pollution of water supplies derived from the surface of pasturable lands. Thus, contamination may arise through cows, while drinking and crossing streams and rivers or while grazing along their banks, discharging their excrement directly into the water or so near the water that the first shower of rain washes such matters into the water. Also it may arise indirectly from the drainage of land manured with cow-dung in the neighbourhood of streams.

Secondly, cow-dung is, owing to the conditions under which milking of cows is too often practised, one of the commonest sources of the pollution of milk.

I have endeavoured by combined quantitative and qualitative examinations to bring my present investigation of cow-dung into line with previous work as regards human fæces, so as to allow valid comparison to be made biologically of excrement from these different sources.

The samples were collected from stall-fed cows in London cow-houses. All samples were fresh; that is, the moment after the cow had defecated, a portion of its excrement was transferred by means of a sterile scoop into a sterile tin vessel, conveyed at once to the laboratory, and examined almost immediately after its arrival there.

SUMMARY OF CONTENTS (DIVISION III.).

B. coli test
B. enteritidis sporogenes test } *of cow-dung.*
Streptococcus test

The methods adopted were substantially those adopted by me in regard of human fæces, and which are described in Appendix B., No. 5, Report of the Medical Officer, Local Government Board, 1902–3.

B. coli test of cow-dung.

The number of B. coli per gramme of cow-dung was as follows :—

Sample 1	1 million
Sample 2	ditto
Sample 3	10 million
Sample 4	100,000
Sample 5	1 million
Sample 6	ditto
Sample 7	ditto
Sample 8	ditto
Sample 9	100,000
Sample 10	10 million

It will be noted that the results varied from 100,000 to 10 million per gramme, but as six out of the ten samples contained not less than 1 million this number is probably a fair estimate of the average number of B. coli in 1 gramme of cow-dung. These results, high as they appear to be, fall short of the number of B. coli usually present in human fæces.

As regards the biological attributes of the B. coli, sixty specimens of B. coli were studied, and the results of this study are given in the accompanying table (Table 1, Division III).

P. B, No. 2.

the teriological amination l) Deep ll Waters; Upland ters; and Cow-Dung; Dr. Houston

TABLE 1, DIVISION III.

Showing the Biological Attributes of 60 specimens of B. coli isolated from 10 samples of fresh cow-dung.

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Descriptive number of B. coli.	Sample.	LD LD LD *Dilution*, —, —, — 1, 10, 100 For explanation *see* footnote.	Isolated by primary bile-salt glucose peptone and secondary gelatine plate method from: Decimals of a gramme.	*Gas* in ordinary gelatine "shake" cultures. +=gas, 24 hours at 20° C.	*Cane sugar peptone test.* A. G.=acid and gas. A. sl. G.=acid and slight gas. A. tr. G.=acid and trace gas, 48 hours at 37° C.	*Neutral red broth.* fl=greenish yellow fluorescence, 48 hours at 37° C.	*Lactose peptone test.* ag=acid and gas, 48 hours at 37° C.	*Indol test* (indol in broth cultures). in=indol, 5 days at 37° C.	*Litmus milk test.* ac=acid and clot, 5 days at 37° C.	Classification on a "flagin" B. coli basis
1	I.	LD/1	·000001	+	0	fl.	0	in	0	fla
2	„	„	·000001	+	0	fl	0	in	0	fla
3	„	LD/10	·00001	+	0	(fl)	ag	in	ac	(fl)agla
4	„	„	·0000:	+	A. G.	fl	ag	in	ac	flagla
5	„	LD/100	·0001	+	0	fl	ag	in	ac	flagla
6	„	„	·0001	+	A. G.	fl	ag	in	ac	flagla
7	II	LD/1	·000001	+	0	fl	ag	in	ac	flagla
8	„	„	·000001	+	0	fl	ag	in	ac	flagla
9	„	LD/10	·00001	+	0	fl	ag	in	ac	flagla
10	„	„	·00001	+	0	fl	ag	in	ac	flagla
11	„	LD/100	·0001	+	0	fl	ag	in	ac	flagla
12	„	„	·0001	+	A. G.	fl	ag	in	ac	flagla
13	III.	LD/1	·0000001	+	0	fl	ag	in	ac	flagla
14	„	„	·0000001	+	0	fl	ag	in	ac	flagla
15	„	LD/10	·000001	+	0	fl	ag	in	ac	flagla
16	„	„	·000001	+	0	fl	ag	in	ac	flagla

TABLE 1—*continued.*

3.	4.	5.	6.	7.	8.	9.	10.	11.
Dilution, LD/1, LD/10, LD/100. For explanation *see* footnote.	Isolated by primary bile-salt glucose peptone and secondary gelatine plate method from: Decimals of a gramme.	*Gas* in ordinary gelatine "shake" cultures. +=gas, 21 hours at 20° C.	*Cane sugar peptone test.* A. G.=acid and gas. A. sl. G.=acid and slight gas. A. tr. G.=acid and trace gas, 48 hours at 37° C.	*Neutral red broth.* fl=greenish yellow fluorescence, 48 hours at 37° C.	*Lactose peptone test.* ag=acid and gas, 48 hours at 37° C.	*Indol test* (indol in broth cultures). in=indol, 5 days at 37° C.	*Litmus milk test.* ac=acid and clot, 5 days at 37° C.	Classification on a "flaginac" B. coli basis.
LD/100	·00001	+	0	fl	ag	in	ac	flaginac
"	·00001	+	0	fl	ag	in	ac	flaginac
LD/1	·00001	+	0	fl	ag	in	ac	flaginac
"	00001	+	0	fl	ag	in	ac	flaginac
LD/10	·0001	+	A. sl. G.	fl	ag	in	ac	flaginac
"	·0001	+	A. sl. G.	fl	ag	in	ac	flaginac
LD/100	·001	+	A. sl. G.	fl	ag	in	ac	flaginac
"	·001	+	A. sl. G.	fl	ag	in	ac	flaginac
LD/1	·000001	+	A. sl. G.	fl	ag	in	ac	flaginac
"	·000001	+	A. sl. G.	fl	ag	in	ac	flaginac
LD/10	·00001	+	0	fl	ag	in	ac	flaginac
"	·00001	+	0	fl	ag	in	ac	flaginac
LD/100	·0001	+	0	fl	ag	in	ac	flaginac
"	·0001	+	0	fl	ag	in	ac	flaginac
LD/1	·000001	+	0	fl	ag	in	ac	flaginac
"	·000001	+	0	fl	ag	in	ac	flaginac
LD/10	·00001	+	0	fl	ag	in	ac	flaginac
"	·00001	+	A. G.	fl	ag	in	0	flag

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TABLE 1—*continued.*

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Descriptive number of B. coli.	Sample.	*Dilution,* LD $\frac{LD}{10}$, $\frac{LD}{1}$, $\frac{LD}{100}$, For explanation *see* footnote.	Isolated by primary bile-salt glucose peptone and secondary gelatine plate method from: Decimals of a gramme.	*Gas* in ordinary gelatine "shake" cultures. +=gas, 24 hours at 20° C.	*Cane sugar peptone test.* A. G.=acid and gas, A. sl. G.=acid and slight gas. A. tr. G.=acid and trace gas, 48 hours at 37° C.	*Neutral red broth.* fl=greenish yellow fluorescence, 48 hours at 37° C.	*Lactose peptone test.* ag=acid and gas, 48 hours at 37° C.	*Indol test* (indol in broth cultures). in=indol, 5 days at 37° C.	*Litmus milk test.* ac=acid and clot, 5 days at 37° C.	Classification on a "flaginae" B. coli basis.
35	VI.	$\frac{LD}{100}$	·0001	+	0	fl	ag	in	ac	flaginae
36	„	„	·0001	+	0	fl	ag	in	ac	flaginae
37	VII.	$\frac{LD}{1}$	·000001	+	A. sl. G.	fl	ag	in	ac	flaginae
38	„	„	·000001	+	A. sl. G.	fl	ag	in	ac	flaginae
39	„	$\frac{LD}{10}$	·00001	+	0	fl	ag	in	ac	flaginae
40	„	„	·00001	+	0	fl	ag	(in)	ac	flag(in)ac
41	„	$\frac{LD}{100}$	·0001	+	A. tr. G.	fl	ag	in	ac	flaginae
42	„	„	·0001	+	0	fl	ag	0	ac	flagac
43	VIII.	$\frac{LD}{1}$	·000001	+	0	fl	ag	in	ac	flaginae
44	„	„	·000001	+	0	fl	ag	in	ac	flaginae
45	„	$\frac{LD}{10}$	·00001	+	0	fl	ag	in	ac	flaginae
46	„	„	·00001	+	0	fl	(ag)	in	ac	fl(ag)inae
47	„	$\frac{LD}{100}$	·0001	+	0	fl	ag	in	ac	flaginae
48	„	„	·0001	+	0	fl	ag	in	ac	flaginae
49	IX.	$\frac{LD}{1}$	·00001	+	A. tr. G.	fl	ag	in	ac	flaginae
50	„	„	·00001	+	A. tr. G.	fl	ag	in	ac	flaginae
51	„	$\frac{LD}{10}$	·0001	+	0	fl	ag	in	ac	flaginae
52	„	„	·0001	+	A. tr. G.	fl	ag	in	ac	flaginae

TABLE 1—*continued.*

1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Descriptive number of B. coli.	Sample.	LD LD LD / 1 , 10 , 100 — *Dilution.* For explanation *see* footnote.	Isolated by primary bile-salt glucose peptone and secondary gelatine plate method from: — Decimals of a gramme.	*Gas* in ordinary gelatine "shake" cultures. +=gas, 24 hours at 20° C.	*Cane sugar peptone test.* A. G.=acid and gas, A. sl. G.=acid and slight gas, A. tr. G.=acid and trace gas, 48 hours at 37° C.	*Neutral red broth.* fl=greenish yellow fluorescence, 48 hours at 37° C.	*Lactose peptone test.* ag=acid and gas, 48 hours at 37° C.	*Indol test* (indol in broth cultures). in=indol, 5 days at 37° C.	*Litmus milk test.* ac=acid and clot, 5 days at 37° C.	Classification on a "flaginac" B. coli basis.
53	IX.	LD / 100	·001	+	A. tr. G.	fl	ag	in	ac	flaginac
54	"	"	·001	+	0	fl	ag	in	ac	flaginac
55	X.	LD / 1	0000001	+	A. sl. G.	fl	ag	in	ac	flaginac
56	"	"	·0000001	+	A. sl. G.	fl	ag	in	ac	flaginac
57	"	LD / 10	·000001	+	0	fl	ag	in	ac	flaginac
58	"	"	·000001	+	0	fl	ag	in	ac	flaginac
59	"	LD / 100	·00001	+	0	fl	ag	in	ac	flaginac
60	"	"	·00001	+	0	fl	ag	in	ac	flaginac

As regards column 3: The colonies of B. coli occurring in the highest or last dilution in which B. coli was present, are called $\frac{LD}{1}$ B. coli (*i.e.*, B. coli representing the last dilution). Those occurring in the plate next in the scale of dilutions are called $\frac{LD}{10}$ B. coli (*i.e.*, B. coli representing the last dilution but one). Those occurring in the plate last but two in the scale of dilutions, are called $\frac{LD}{100}$ B. coli (*i.e.*, B. coli representing the next but one to the last dilution)

Fifty-three out of 60 (88 per cent.) of the B. coli thus isolated proved flaginac B. coli. The corresponding percentage in human fæces and in domestic sewage is about 85 per cent. It is obvious, then, that it is impossible to differentiate between the B. coli of bovine and human origin by means of the neutral red broth (fl.), lactose peptone (ag.), indol (in.), and litmus milk (ac.) tests.

As regards the cane-sugar peptone test the results may be classified as follows :—

41 out of 60 (68·3 per cent.), negative results.

15 out of 60 (25 per cent.) yielded acid and only slight amount or traces of gas (incompletely positive result).

4 out of 60 (6·6 per cent.), gave positive results.

The large number of completely negative and incompletely positive results is very striking, and it agrees with my experience of the B. coli of human fæces, and, but to a less extent, of the B. coli of sewage.

Although it is hardly justifiable to assign to an unimportant position, as regards evidence of objectionable contamination, a flaginac B. coli which does ferment cane-sugar, it is equally true that a flaginac B. coli which *does not* ferment this sugar, or ferments it only feebly, is more significant of animal intestinal pollution.

The above results are of considerable interest because in milk, although B. coli are usually numerous, a far higher proportion of them than 30 per cent. ferment cane-sugar. This, in my opinion, tends to some extent to exculpate milk in the matter of excremental contamination, or at least to suggest that the source of B. coli in milk is not solely *fresh* cow-dung or *fresh* human fæces.

Taking the other tests severally of cow-dung and contrasting them with the results previously obtained as regards human fæcal B. coli, the following interesting table is obtained :—

B. coli isolated from—	Neutral red broth test, for fluorescence.	Lactose peptone cultures, for acid and gas formation.	Broth cultures, for indol formation.	Litmus milk cultures, for acid clotting.
	Per cent. positive.	Per cent. positive.	Per cent. positive.	Per cent. positive.
Cow dung	98·3	96·7	96·7	95
Human fæces	98	92	98	92

On the basis of these tests it would be impossible therefore to distinguish, by the characters of B. coli alone, between the contamination of a water with human excrement and contamination of it with cow-dung.

B. enteritidis sporogenes test of cow-dung.

The results as regards this test may be tabulated as follows :—

Sample							
I.	Present in	·001	gramme	(=1,000	per	gramme).
II.	„	„ ·0001	„	(10,000	„	).
III.	„	„ ·001	„	(1,000	„	).
IV.	„	„ ·01	„	(100	„	).
V.	„	„ ·0001	„	(10,000	„	).
VI.	„	„ ·01	„	(100	„	).
VII.	„	„ ·00001	„	(100,000	„	).
VIII.	„	„ ·0001	„	(10,000	„	).
IX.	„	„ ·0001	„	(10,000	„	).
X.	„	„ ·0001	„	(10,000	„	).

It will be noted that the results showed from 100 to 100,000 B. enteritidis sporogenes per gramme. Usually the result was 10,000 per gramme. These figures, although high, are lower than was the case with this anærobe as regards human fæces.

Excremental pollution of water, as judged by this test, might equally well be of bovine as of human origin.

Streptococcus test of cow-dung.

No less than 100 streptococci were isolated from cow-dung and separately studied.

Relative abundance of streptococci in cow-dung.—The streptococci were isolated from amounts of cow-dung as follows :—

$\frac{1}{10000}$ gramme.—Streptococci Nos. 6, 7, 8, 9, 10, 11, 12 (Sample 2); 13 and 14 (Sample 3); 48, 49, 50, 51, and 52 (Sample 5); 59, 60, 61, 62, and 63 (Sample 6).

$\frac{1}{100000}$ gramme.—Streptococci Nos. 2 and 3 (Sample 1); 4 and 5 (Sample 2); 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, and 34 (Sample 4); 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, and 47 (Sample 5); 53, 54, 55, 56, 57, and 58 (Sample 6); 70, 71, 72, 73, and 74 (Sample 7); 98, 99, and 100 (Sample 10).

$\frac{1}{1000000}$ gramme.—Streptococci Nos. 1 (Sample 1); 17, 18, 19, and 20 (Sample 4); 67, 68, and 69 (Sample 7); 78, 79, 80, 81, 82, 83, and 84 (Sample 8); 95, 96, and 97 (Sample 10).

$\frac{1}{10000000}$ gramme.—Streptococci Nos. 15 and 16 (Sample 4); 64, 65, and 66 (Sample 7); 75, 76, and 77 (Sample 8); 85, 86, 87, 88, 89, 90, 91, 92, 93, and 94 (Sample 9).

Morphology of the cow-dung streptococci.—Morphology is apt to be a doubtful aid to differentiation of species. But a broad classification is here not difficult; practically all the streptococci formed short chains.

Short chains:—Streptococci Nos. 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 95, 96, 97 98, 99, 100.

Long chains:—Streptococci Nos. 17, 93 (chains somewhat coherent), 94.

The majority of human fæcal streptococci likewise form short chains. In milk a larger proportion of streptococci form medium to long chains than is observed among bovine or human fæcal streptococci.

Broth cultures of cow-dung streptococci.—All the streptococci formed diffuse cloudiness (or uniform turbidity) with the exception of—

Streptococcus 17, which showed a flaky growth in otherwise clear broth.

Streptococcus 93, which showed a "cumulus" growth in otherwise clear broth.

Streptococcus 94, which showed a flocculent growth in otherwise clear broth.

The majority of human fæcal streptococci likewise produce uniform turbidity in broth cultures.

As regards milk, a smaller proportion of streptococci present in it give rise to uniform turbidity in broth cultures than is the case with streptococci derived from cow-dung or human fæces.

Nitrate broth test of cow-dung streptococci.—All the 100 streptococci were thus tested, but none of them reduced nitrates to nitrites. Out of 200 human fæcal streptococci tested in the same way none reduced nitrates to nitrites. Milk strepococci, in my experience, likewise yield negative results in this sense.

As regards the eight tests—salicin, saccharose, lactose, raffinose, litmus milk, neutral red (anærobic), inulin, and mannite—the results are shown in the table (Table 2, Division III.). As stated in my last year's report, the use of these tests in connection with the study of streptococci was suggested to me by Dr. Gordon.

TABLE 2. DIVISION 3.

Showing the Biological attributes of 100 specimens of streptococci isolated from 10 samples of fresh cow-dung.

Cols. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Descriptive number of streptococcus.	Sample.	Isolated from Drigalski and Conradi plates inoculated with: Decimals of a gramme.	*Salicin test.* 48 hours at 37° C. + = acid change.*	*Saccharose test.* 48 hours at 37° C. + = acid change.	*Lactose test.* 48 hours at 37° C. + = acid change.	*Litmus milk test.* 48 hours at 37° C. + = acid and clot.	*Neutral red broth test* (anaërobic). 48 hours at 37° C. + = fluorescence.	*Raffinose test.* 48 hours at 37° C. + = acid change.	*Mannite test.* 48 hours at 37° C. + = acid change.	*Inulin test.* 48 hours at 37° C. + = acid change.
1	I	·00001	+	+	+	+	0	+	0	0
2	„	·0001	+	+	+	+	0	+	0	0
3	„	·0001	+	+	+	+	0	+	0	0
4	II.	·0001	+	0	0	+	0	0	0	0
5	„	·0001	+	0	0	+	0	0	0	0
6	„	·001	+	+	+	+	0	+	0	0
7	„	·001	+	+	+	+	0	+	0	0
8	„	·001	+	+	+	+	0	+	0	0
9	„	·001	+	+	+	+	0	0	0	0
10	„	·001	+	+	+	+	0	+	0	0
11	„	·001	+	+	+	+	0	0	0	0
12	„	·001	+	+	+	+	0	+	0	0
13	III.	·001	+	+	+	+	0	+	0	0
14	„	·001	+	+	+	+	0	+	0	0
15	IV.	·000001	+	+	0	+	0	0	0	+
16	„	·000001	+	+	0	+	0	0	0	+
17	„	·00001	0	+	+	+	0	0	0	0
18	„	·00001	+	+	+	+	0	+	0	0
19	„	·00001	+	0	+	+	0	0	0	0
20	„	·00001	+	+	+	+	0	+	0	0
21	„	·0001	+	+	+	0	0	+	0	0
22	„	·0001	+	+	+	+	0	+	0	0
23	„	·0001	+	0	0	+	0	+	0	0
24	„	·0001	+	0	+	0	0	+	0	0
25	„	·0001	+	+	0	+	0	0	0	0
26	„	·0001	+	+	+	+	0	+	0	0
27	„	·0001	+	+	0	+	0	+	0	0

* As regards columns 4, 5, 6, 9, 10 and 11, the composition of the medium was as follows:—Liebig's Extract of Meat, 1 per cent.; peptone, 1 per cent.; sodium carbonate 0·1 per cent.; × sugar, 0·5 per cent.; water, 97·4 per cent. (tinted with litmus solution).

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TABLE 2—*continued.*

Cols. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Descriptive number of streptococcus.	Sample.	Isolated from Drigalski and Conradi plates inoculated with: Decimals of a gramme.	*Salicin test.* 48 hours at 37° C. + = acid change.*	*Saccharose test.* 48 hours at 37° C. + = acid change.	*Lactose test.* 48 hours at 37° C. + = acid change.	*Litmus milk test.* 48 hours at 37° C. + = acid and clot.	*Neutral red broth test* (anaërobic). 48 hours at 37° C. + = fluorescence.	*Raffinose test.* 48 hours at 37° C. + = acid change.	*Mannite test.* 48 hours at 37° C. + = acid change.	*Inulin test.* 48 hours at 37° C. + = acid change.
28	IV.	·0001	+	+	+	+	0	+	0	0
29	„	·0001	+	0	0	+	0	0	0	0
30	„	·0001	+	0	0	+	0	0	0	0
31	„	·0001	+	+	+	0	0	0	0	0
32	„	·0001	+	+	+	+	0	+	0	0
33	„	·0001	+	0	+	+	0	0	0	0
34	„	·0001	+	+	+	0	0	+	0	0
35	V.	·0001	+	+	+	0	0	+	0	0
36	„	·0001	0	+	0	+	0	0	0	+
37	„	·0001	+	+	+	0	0	+	0	0
38	„	·0001	+	+	+	+	0	+	0	0
39	„	·0001	+	+	+	+	0	+	0	0
40	„	·0001	+	+	+	+	0	+	0	0
41	„	·0001	+	+	+	+	0	+	0	+
42	„	·0001	+	+	+	+	0	+	0	0
43	„	·0001	0	+	0	+	0	0	0	0
44	„	·0001	+	+	0	+	0	+	0	0
45	„	·0001	+	+	+	+	0	+	0	+
46	„	·0001	+	0	0	+	0	+	0	0
47	„	·0001	+	+	+	+	0	+	0	0
48	„	·001	+	0	+	+	0	0	0	+
49	„	·001	+	+	+	+	0	+	0	0
50	„	·001	+	+	0	+	0	+	0	0
51	„	·001	+	+	0	+	0	+	0	0
52	„	·001	+	+	+	+	0	+	0	+
53	VI.	·0001	+	+	+	+	0	+	0	0
54	„	·0001	+	+	+	0	0	+	0	0
55	„	·0001	+	+	+	+	0	+	0	0
56	„	·0001	+	+	+	+	0	+	0	0
57	„	·0001	+	+	+	0	0	+	0	0

* As regards columns 4, 5, 6, 9, 10 and 11, the composition of the medium was as follows:—Liebig's Extract of Meat, 1 per cent.; peptone, 1 per cent.; sodium carbonate, 0·1 per cent.; × sugar, 0·5 per cent.; water, 97·4 per cent. (tinted with litmus solution).

TABLE 2—*continued.*

Cols. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Descriptive number of streptococcus.	Sample.	Isolated from Drigalski and Conradi plates inoculated with: Decimals of a gramme.	*Salicin test.* 48 hours at 37° C. + = acid change.*	*Saccharose test.* 48 hours at 37° C. + = acid change.	*Lactose test.* 48 hours at 37° C. + = acid change.	*Litmus milk test.* 48 hours at 37° C. + = acid and clot.	*Neutral red broth test* (anaërobic). 48 hours at 37° C. + = fluorescence.	*Raffinose test.* 48 hours at 37° C. + = acid change.	*Mannite test.* 48 hours at 37° C. + = acid change.	*Inulin test.* 48 hours at 37° C. + = acid change.
58	VI.	·0001	+	+	+	+	0	+	0	0
59	,,	·001	+	+	+	0	0	+	0	0
60	,,	·001	+	+	+	+	0	+	0	0
61	,,	·001	+	+	+	+	0	+	0	0
62	,,	·001	+	+	+	0	0	+	0	0
63	,,	·001	+	+	+	+	0	+	0	0
64	VII.	·000001	+	+	+	0	0	+	0	0
65	,,	·000001	+	+	+	0	0	+	0	0
66	,,	·000001	+	+	+	0	0	+	0	0
67	,,	·00001	+	+	+	0	0	+	0	0
68	,,	·00001	+	+	+	+	0	+	0	0
69	,,	·00001	+	+	+	+	0	+	0	0
70	,,	·0001	+	+	+	+	0	+	0	0
71	,,	·0001	+	+	+	+	0	+	0	0
72	,,	·0001	+	+	+	0	0	+	0	0
73	,,	·0001	+	+	+	+	0	+	0	0
74	,,	·0001	+	+	+	+	0	+	0	0
75	VIII.	·000001	+	+	+	0	0	0	0	0
76	,,	·000001	+	+	+	0	0	+	0	0
77	,,	·000001	+	+	+	0	0	+	0	0
78	,,	·00001	+	+	+	0	0	0	0	0
79	,,	·00001	+	+	+	0	0	0	0	0
80	,,	·00001	+	+	+	0	0	0	0	0
81	,,	·00001	+	+	+	0	0	0	0	0
82	,,	·00001	+	+	+	0	0	0	0	0
83	,,	·00001	+	+	+	0	0	0	0	0
84	,,	·00001	+	+	+	0	0	0	0	0
85	IX.	·000001	+	+	+	+	0	+	0	+
86	,,	·000001	+	+	+	+	0	+	0	+
87	,,	·000001	+	+	+	+	0	+	0	+

* As regards columns 4, 5, 6, 9, 10 and 11, the composition of the medium was as follows:—Liebig's Extract of Meat, 1 per cent.; peptone, 1 per cent.; sodium carbonate, 01 per cent.; × sugar, 05 per cent.; water, 97·4 per cent. (tinted with litmus solution).

On the Bacteria Examin of (1) De Well Wa (2) Upla Waters; (3) Cow. by Dr. H

TABLE 2—*continued.*

Cols. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
Descriptive number of streptococcus.	Sample.	Isolated from Drigalski and Conradi plates inoculated with: Decimals of a gramme.	*Salicin test.* 48 hours at 37° C. + = acid change.*	*Saccharose test.* 48 hours at 37° C. + = acid change.	*Lactose test.* 48 hours at 37° C. + = acid change.	*Litmus milk test.* 48 hours at 37° C. + = acid and clot.	*Neutral red broth test* (anaërobic). 48 hours at 37° C. + = fluorescence.	*Raffinose test.* 48 hours at 37° C. + = acid change.	*Mannite test.* 48 hours at 37° C. + = acid change.	*Inulin test.* 48 hours at 37° C. + = acid change.
88	IX	·000001	+	+	+	+	0	+	0	0
89	„	·000001	+	+	+	+	0	+	0	0
90	„	·000001	+	+	+	+	0	+	0	0
91	„	·000001	+	+	+	+	0	+	0	0
92	„	·000001	+	+	+	+	0	+	0	0
93	„	·000001	+	+	+	+	0	0	0	0
94	„	·000001	0	+	+	0	0	0	0	+
95	X	·00001	+	+	+	+	0	+	0	0
96	„	·00001	0	0	+	+	0	+	0	0
97	„	·00001	0	+	+	+	0	+	0	0
98	„	·0001	+	+	+	+	0	+	0	+
99	„	·0001	+	+	+	0	0	+	0	+
100	„	·0001	+	+	+	+	0	+	0	0

* As regards columns 4, 5, 6, 9, 10 and 11, the composition of the medium was as follows:—Liebig's Extract of Meat, 1 per cent.; peptone, 1 per cent.; sodium carbonate, 0·1 per cent.; × sugar, 0·5 per cent.; water, 97·4 per cent. (tinted with litmus solution).

The facts recorded in the above table may be briefly summarised as follows :—

Salicin ...	...	...	93 per cent. positive result.
Saccharose	...	...	89 „ „
Lactose ...	...	...	85 „ „
Litmus milk	...	...	73 „ „
Neutral red	...	...	All gave *negative* results.
Raffinose	...	...	74 per cent. positive result.
Mannite...	..	...	All gave *negative* results.
Inulin ...	...	...	13 per cent. positive result.

As compared with human fæcal streptococci, the striking features are the negative results obtained with the neutral red and mannite tests, and the large proportion of streptococci

yielding positive results with the raffinose tests. The streptococci of milk also yield results which in some respects are not in agreement with the foregoing—as the following comparative table shows :—

Streptococci.

—	Cow dung Per cent. +.	Human fæces Per cent. +.	Milk Per cent. +.
Salicin test	93	92·67	60
Saccharose test	89	86·34	90
Lactose test	85	76·34	97
Litmus milk test	73	61·67	70
Neutral red broth test	All negative	39·34	20
Raffinose test	74	32·00	19
Mannite test	All negative	24·34	20
Inulin test	13	4·67	21

A further analysis of the foregoing table shows that the streptococci of cow-dung may be divided into groups as follows :—

100 Streptococci.

(1.) Salicin, saccharose, lactose, litmus milk, and raffinose positive, other tests negative. Streptococci 1, 2, 3, 6, 7, 8, 10, 12, 13, 14, 18, 20, 22, 26, 28, 32, 38, 39, 40, 42, 47, 49, 53, 55, 56, 58, 60, 61, 63, 68, 69, 70, 71, 73, 74, 88, 89, 90, 91, 92, 95, and 100, 42 per cent., as compared with 8 per cent. in human fæces and 1·16 per cent. in milk.

(2.) Salicin and litmus milk positive, other tests negative. Streptococci 4, 5, 29, and 30, 3 per cent., not represented in human fæces or in milk.

(3.) Salicin, saccharose, lactose, and litmus milk positive, other tests negative. Streptococci 9, 11, and 93, 3 per cent., as compared with 7·34 per cent. in human fæces and 26 per cent. in milk.

(4.) Salicin, saccharose, litmus milk, and inulin positive, other tests negative. Streptococci 15 and 16, 2 per cent., not represented in human fæces or in milk.

(5.) Saccharose, lactose, and litmus milk positive, other tests negative. Streptococcus 17, 1 per cent., as compared with 2·67 in human fæces and 12 per cent. in milk.

(6.) Salicin, lactose, and litmus milk positive, other tests negative. Streptococci 19 and 33, 2 per cent., as compared with 6·67 in human fæces and 1·7 per cent. in milk.

(7.) Salicin, saccharose, lactose, and raffinose positive, other tests negative. Streptococci 21, 34, 35, 37, 54, 57, 59, 62, 64, 65, 66, 67, 72, 76, and 77, 15 per cent., not represented in human fæces, 1·16 per cent. in milk.

(8.) Salicin, litmus milk, and raffinose positive, other tests negative. Streptocci 23 and 46, 2 per cent. not represented in human fæces or in milk.

(9.) Salicin, lactose, and raffinose positive, other tests negative. Streptococcus 24, 1 per cent. not represented in human fæces or in milk.

(10.) Salicin, saccharose, and litmus milk positive, other tests negative. Streptococcus 25, 1 per cent., as compared with 0·67 per cent. in human fæces not represented in milk.

(11.) Salicin, saccharose, litmus milk, and raffinose positive, other tests negative. Streptococci 27, 44, 50, and 51, 4 per cent. not represented in human fæces or in milk.

(12.) Salicin, saccharose, and lactose positive, other tests negative. Streptococci 31, 75, 78. 79, 80, 81, 82, 83, and 84, 9 per cent. as compared with 8·67 in human fæces and 3·4 per cent. in milk.

(13.) Saccharose, litmus milk, and inulin positive, other tests negative. Streptococcus 36, 1 per cent. not represented in human fæces or in milk.

(14.) Salicin, saccharose, lactose, litmus milk, raffinose, and inulin positive, other tests negative. Streptococci 41, 45, 52, 85, 86, 87, and 98, 7 per cent. not represented in human fæces or in milk.

(15.) Saccharose and litmus milk positive, other tests negative. Streptococcus 43, 1 per cent., as compared with 1·34 per cent., in human fæces, not represented in milk.

(16.) Salicin, lactose, litmus milk, and inulin positive, other tests negative. Streptococcus 48, 1 per cent. not represented in human fæces or in milk.

(17.) Saccharose, lactose, and inulin positive, other tests negative. Streptococcus 94, 1 per cent. not represented in human fæces or in milk.

(18.) Lactose, litmus milk, and raffinose positive, other tests negative. Streptococcus 96, 1 per cent. not represented in human fæces or in milk.

(19.) Saccharose, lactose, litmus milk, and raffinose positive, other tests negative. Streptococcus 97, 1 per cent., as compared with 0·34 per cent., in human fæces and 4 per cent. in milk.

(20.) Salicin, saccharose, lactose, raffinose, and inulin positive, other tests negative. Streptococcus 99, 1 per cent. not represented in human fæces or in milk.

The large number of cow-dung streptococci (42 per cent.) coming under the salicin, saccharose, lactose, litmus milk, and raffinose group is striking. In human fæces this group numbered only 8 per cent.; in milk it is only 1·16 per cent.

A 15 per cent. group not found by me in human fæces was the salicin, saccharose, lactose, and raffinose group. Only 1·16 per cent. of milk streptococci come under this heading.

A 9 per cent. group, as compared with 8·67 in human fæces and 3·4 per cent. in milk, was the salicin, saccharose, and lactose group.

A 7 per cent. group not found by me in human fæces or in milk was the salicin, saccharose, lactose, litmus milk, raffinose and inulin group.

These four groups account for 73 per cent. (nearly three-quarters) of the total number of cow-dung streptococci while including only 16 per cent. (about one sixth) of the human fæced streptococci, and no more than 5·72 per cent. of the milk streptococci.

As many of the streptococci of cow-dung differ from the streptococci found in milk, it would seem that not all of the streptococci found in milk are derived from contamination with the *fresh* excrement of the cow. Some of the milk streptococci are contributed probably from the udder of the cow and some from dust.

Summarising the above facts as to cow excrement, it is to be noted that B. coli, spores of B. enteritidis sporogenes, and streptococci are present in cow-dung in great number. As regards the first two tests, the results obtained by me do not suggest a means of distinguishing between human and bovine pollution of (say) water. But as regards the streptococcus test, the absence of ability to produce acid in a mannite medium and failure to produce fluorescence in neutral red broth cultures (anaerobic), and the power of attacking raffinose as well as salicin, saccharose, and lactose, with ability, likewise to clot milk is certainly suggestive of a streptococcus derived from cow-dung. The discovery, therefore, in a water of a number of streptococci the majority of which produced acid in a raffinose medium but not in a mannite medium and which produced no fluorescence in neutral red broth cultures would, on the basis of the foregoing results, point clearly to the pollution being more likely to be of bovine than of human origin.

As regards a comparison of the B. coli and streptococci of milk with the B. coli and streptococci of cow-dung :—The milk streptococci more commonly form medium to long chains and less often give rise to diffuse cloudiness in broth culture. Moreover, they less often yield positive results with the salicin and raffinose tests, and more often positive results with the neutral red and mannite tests. The milk B. coli more often yield positive results with the cane-sugar test.

General Summary and Conclusions.

In each separate division (Divisions I., II., and III.) of this report I have endeavoured to summarise results and to draw certain conclusions, chiefly of a tentative kind. It is desirable, however, to bring these various considerations together, as far as possible, in a concise and intelligible form.

In the first place, it is important to note that deep well waters (*e.g.*, Tunbridge Wells deep well waters) derived from distant and virgin sources yielded the following results as regards the B. coli test* :—

None of the 49 samples contained any *typical* B. coli in 100 cc. of water (100 per cent. negative).

26 out of 27 samples contained no *typical* B. coli in 1,000 cc. of water (96 per cent. negative).

As regards *gas-forming coli-like microbes* (including markedly atypical microbes) the results were as follows :—

1,000 cc. of Water.	100 cc. of Water.	10 cc. of Water.	1 cc. of Water.
19 out of 27 samples, *negative* results (70 per cent.).	45 out of 49 samples, *negative* results (91 per cent.).	48 out of 49 samples, *negative* results (98 per cent.).	49 out of 49 samples, *negative* results (100 per cent.).

These results show clearly that B. coli, and even coli-like microbes, were practically absent from these deep well waters.

Secondly, as regards the waters of Loch Laggan and Loch Ericht it needs to be pointed out that Loch Ericht is cut off practically from all sources of possible human pollution and can only be contaminated by the excreta of birds and of lower animals; and that on the other hand Loch Laggan is less happily situated, as some of the burns and rivers feeding it being liable to pollution from manured land and by the excreta of man as well as of birds and of lower animals. Nevertheless, in view of its large size, the pollutions of Loch Laggan cannot be regarded as serious. Both lochs contained numerous trout.

Tested in respect of B. coli these several waters gave results broadly as follows :—

B. coli test.

—	Negative 100 cc. (per cent.)	+ 100 cc. (per cent)	+ 10 cc. (per cent.)	+ 1 cc. (per cent.)	+ $\frac{1}{10}$ cc. (per cent.)
Burns and rivers flowing into Loch Laggan, 26 samples.	—	3·8	34·6	53·8	7·7
Loch Laggan, 85 samples	16·4	49·4	33	1·17	—
Loch Ericht, 100 samples	80	19	1	—	—

* For the sake of completeness the results obtained in 1902–3 are included here.

The burn and river samples "feeding" Loch Laggan yielded more B. coli than from my incomplete topographical observations I had anticipated. The smaller number of B. coli in the Loch Laggan than in the burn samples is due probably less to sedimentation than to the continual loss of vitality of these microbes in the relatively pure loch water. These results point to the danger of adopting stringent standards as regards the B. coli test. For example, if samples of water containing B. coli in 10 cc. are open to condemnation 96 per cent. of the burn and river and 34 per cent. of the Loch Laggan samples would be objected to on this basis, a condemnation not justified on the observed topographical facts. If a less stringent standard be applied (negative result with 1 cc. of water) about 61 per cent. of the burn and river and only about 1 per cent. of the loch samples would be liable to condemnation.

As regards the Loch Ericht samples, the results were undeniably satisfactory—80 per cent. of the samples containing no B. coli or coli-like microbes even in 100 cc. This result is quite in keeping with the topographical surroundings of this loch.

Thirdly, it is to be observed that the Loch Ericht results do not support a contention that fish living in pure non-sewage-polluted deep loch water can seriously detract from the value of the results of the B. coli test by contaminating such water with any appreciable number of B. coli derived from their excrement.

Fourthly, although no large amount of water was used for cultural purposes in connection with the B. enteritidis sporogenes test, it may be desirable to show that statements as to the ubiquity of this anærobe are not supported by the results of my own observations, which are set forth in the following table :—

B. Enteritidis sporogenes test.

—	Negative 10 cc.	+ 10 cc.	+ 1 cc.
31 samples of Tunbridge Wells deep well waters.	31 out of 31 samples, *negative* results (100 per cent.).	None.	None.
26 samples of burns and rivers flowing into Loch Laggan.	23 out of 26 samples, *negative* results (88 per cent.).	3 out of 26 samples, *positive* results (11 per cent.).	None.
85 samples of Loch Laggan water.	81 out of 85 samples, *negative* results (95 per cent.).	4 out of 85 samples, *positive* results, (4·7 per cent.).	None.
100 samples of Loch Ericht water.	99 out of 100 samples, *negative* results (99 per cent.).	1 out of 100 samples, *positive* results (1 per cent.).	None.

Out of a total therefore of 242 samples, only 8 (3·3 per cent.) yielded a positive result as regards B. enteritidis sporogenes with 10 cc. of water.

The examination of an even larger number of sewage samples enables me to definitely affirm that sewage commonly yields a positive result with from ·01 to ·001 cc. (100 to 1,000 per cc.).

Fifthly, in reference to the biological attributes of the B. coli isolated from the various waters: It is clear that the few B. coli found in the Tunbridge Wells deep well waters and in the Loch Ericht samples were practically always atypical in the former and usually atypical in the latter. On the other hand, the B. coli isolated from the burns and rivers flowing into Loch Laggan and from the water in Loch Laggan were usually typical except that the proportion of these typical B. coli fermenting cane-sugar was greater than is found in the cases of human fæces or cow-dung.

Sixthly, dealing with the bacteriological examination of cow dung it should be noted that neither by means of the B. coli nor of the B. enteritidis sporogenes tests would it seem practically possible to distinguish, as regards a polluted water, whether excretal contamination had come from a human or a bovine source. On the other hand, it is to be noted that many of the streptococci of cow-dung differ in their biological attributes from the streptococci of human fæces.

Lastly, contrasting the bacterial flora of cow-dung with the bacterial flora of milk, it is to be noted that fewer of the B. coli of cow-dung ferment cane-sugar than is the case in milk; and, further, that many of the streptococci of cow-dung differ conspicuously from the streptococci of milk. It follows therefore that in dealing bacteriologically with milk samples, great caution should be observed before attributing the quantitive results as regards the B. coli and streptococcus tests *solely* to contamination with the *fresh* excrement of the cow.

No. 3.

REPORT on the CHEMICAL PRODUCTS of the BACILLUS ENTERITIDIS SPOROGENES, and their PHYSIOLOGICAL ACTION; By Dr. SIDNEY MARTIN, F.R.S.

The bacillus enteritidis sporogenes, as regards its morphology and its pathogenic action, has been fully described by Dr. Klein in former reports of the Medical Officer. It is an anaërobic putrefactive micro-organism, which is held to have been the cause of some epidemics of diarrhœa. It has been found in milk and is present in sewage. Its action in milk, as Dr. Klein has shown, is very characteristic. If the spores are added to sterile milk and the tube incubated in the absence of oxygen, the milk is coagulated and the casein is broken up into masses, with the formation of a large quantity of gas.

The bacillus rapidly digests solidified serum and grows also in broth.

In the experiments now to be recorded the micro-organism was usually obtained by injecting one of the stock laboratory cultures subcutaneously into a guinea-pig. After the death of the animal, which occurred in 36 to 48 hours, a culture was made from the local lesion on solid serum and in milk. Throughout the research, solid serum tubes, which became liquefied with the growth of the micro-organism, were used in the experiments. From time to time the pathogenic action of the cultures was tested on guinea-pigs and fresh cultures were obtained from the local lesion. No difficulty was experienced in keeping the cultures uncontaminated.

1. *Growth in Broth.*

The growth of the bacillus in broth is not so copious as in the other media to be described, but is nevertheless fairly active. It causes putrefaction of the peptone present in the broth without much formation of gas. If after 7, 14, or 21 days the bacilli are filtered off through a Chamberland filter, the broth on injection in varying doses into animals—rabbits and guinea-pigs—is not found to have any appreciable action. There is no alteration in the temperature or body weight, and the animals remain quite well. No products with any marked physiological action are therefore formed in broth.

2. *Growth in Liquid Serum.*

Sheeps' serum was filtered through a Chamberland filter to make it sterile, and 50 cc. of the filtrate were placed in each of three tubes. A good growth occurred in all the tubes in five days after adding the spores of the bacillus. Gradually a precipitate formed, which contained the colouring-matter present in

the serum. The liquid became very turbid and foul-smelling. In twenty-eight days chloroform was added to the tubes, the liquid being then centrifugalised and afterwards filtered through a Chamberland filter. The filtrate was strongly alkaline to litmus and contained a large quantity of unchanged serum proteids. A small quantity of albumose was also present, as shown by the biuret reaction obtained after removal of the coagulable proteids. The amount of albumose present, however, was very small, and the slight action of the bacillus in digesting the serum was in marked contrast to its action on solid serum. This was confirmed by an experiment to determine whether any proteolytic ferment was present in the filtered serum after the growth of the bacillus. The filtrate was found to have no digestive action in the absence of the bacillus, such as occurs in the case of the products from the solid serum.

3. *Growth in Alkali-Albumin Broth.*

This culture fluid was made by transforming most of the proteid in filtered sheeps' serum into alkali-albumin by caustic soda, boiling and straining the liquid so as to remove a large part of the proteid, and mixing with equal parts of acid broth. Hydrochloric acid was then added to the liquid until it was only just alkaline. The bacillus grows very well in this culture liquid. The changes which the liquid undergoes are first turbidity, due to the growth of the bacillus, and then a dense precipitate is formed of the proteid, which is finally for the most part dissolved (digested) by the action of the bacillus. During this time the liquid becomes strongly alkaline. There was no variation in the transformation which the culture liquid undergoes in the six experiments that were performed. 150 cc. of the culture liquid were placed in a narrow-necked bottle, and sterilised. While still hot, sterile olive oil was poured on the top of the liquid. Through this oil the liquid was inoculated with the bacillus by means of a pipette. It grew freely when placed in an incubator, the layer of oil ensuring the growth under practically anaërobic conditions. After incubation the liquid was separated from the oil by a separating funnel. The chemical transformations which went on in the culture liquid were the same in all cases, namely, the gradually increasing alkalinity of the liquid, and the digestion of the proteid by the bacillus. The digestion products of the proteid were found to be mainly albumose, which was separated and obtained as a light brown powder; giving in solution no precipitate with nitric acid, a precipitate by saturation with ammonium sulphate, and a bright biuret reaction with copper sulphate and potash. Products soluble in alcohol were also separated from the liquid and dried over sulphuric acid.

The physiological action of the liquid when the bacilli were removed by a Chamberland filter was practically nil. 4 cc., injected into a marginal vein of the ear of a rabbit, produced no effect on the temperature and caused no obvious symptoms in the animal. Similarly 4 cc. injected subcutaneously into a guinea-pig produced no obvious effect.

Of the separated albumose, 0·2 gramme was injected into the marginal vein of a rabbit with no obvious effect, and a large quantity of the alcoholic extract injected in the same way also produced no effect. It is clear from these results that the digestive and final products produced by the bacillus from proteids have no marked physiological action.

4. *Growth in Solid Serum.*

The bacillus rapidly liquefies solid serum, and for obtaining the products of its action in large quantities the following method was adopted:—

150 to 200 cc. of fresh and filtered sheeps' serum were placed in sterile bottles, closed by cotton-wool pads. The liquid in a bottle was then slowly heated in a steamer in order to produce uniform coagulation of the serum. The contents of the bottle after steaming was a solid mass of coagulated serum. After inoculation in the centre of the serum with the bacillus, the bottles were placed in a large jar with pyrogallic acid and incubated. As a result of many experiments it was found that in seven to nine days most of this solid serum became liquefied, only a few solid particles remaining at the bottom of the bottle.

The chemical changes occurring in the solid serum by the action of the bacillus are for the most part the same as those occurring in the alkali-albumin medium. The bacillus, however, grows more rapidly in solid serum than it does in alkali-albumin, and much more rapidly than it grows in broth. At the end of a week's incubation the liquefied serum is strongly alkaline. No coagulable proteid is present, there being no precipitate on boiling the liquid. Strong nitric acid causes a dense precipitate, which is mostly soluble in excess of the reagent, and mostly soluble on heating, reappearing on cooling. This is the reaction for proto-albumose. Ammonium sulphate gives a precipitate which when dissolved in water gives, like the original liquefied serum, a good biuret reaction. The solid serum has therefore been transformed by the bacillus into albumoses, as well as other products which are soluble in alcohol.

After being filtered through a Chamberland filter, the liquefied serum was not found to possess any obvious toxic action in the rabbit, whether on the temperature or the body weight, or in the production of any general symptoms. This fact confirms what has already been stated as the result of the experiments with the products of this bacillus from alkali-albumin.

The liquefied serum, from which the bacillus has been removed by filtration, possesses a well marked proteolytic action. This was tested in the following way:—

Tubes of solid serum were made in the ordinary manner, as used for cultures, that is with a sloped surface, and after being sterilised, the filtered liquefied serum was added to the tube, so as to be in contact with the slope of solid serum for about two-thirds of its extent.

In one experiment it was found that after three days of incubation the opaque solid serum in contact with the liquid became gelatinised, and subsequently disintegrated and dissolved. The surface of the solid serum in other experiments became eroded and broken up into small particles. Throughout the experiments the liquid remained clear, no bacteria growing in it.

It is quite evident that a powerful proteolytic ferment is formed by the bacillus and excreted by it, and that it is this ferment which causes rapid liquefaction of the solidified serum, and that the liquefaction of the serum is not due to the bacillus itself, but to the ferment it excretes.

No toxic effect having been obtained with the products of the bacillus in rabbits and guinea-pigs, an experiment was performed to see whether the products had any effect on blood pressure.

A cat weighing 2,240 grammes was etherised and the blood pressure in the carotid artery recorded. Injections of the filtered liquefied serum, 5 cc. each, were made intravenously. In all, four injections were made at intervals of several minutes. The respiration was taken at the same time as the blood pressure. It was not found that the injections, even towards the end of the experiment, had any marked effect in causing a rise or fall of blood pressure. There was no effect whatever on respiration. After the first injection the blood pressure curve became slightly irregular and wavy. This was observed to a slighter extent after the second injection, but was more marked after the third, when the wavy character of the pressure curve somewhat resembled that of Traube-Hering curves. After the fourth injection there was but little effect. At this time, however, between the third and fourth injections it was noted that the animal required very little anæsthetic to keep it unconscious, and the state of coma remained after the anæsthetic was withheld when the animal was killed. Therefore, the products did seem to have some effect in producing coma, although this effect could not be obtained in rabbits.

There being no pronounced physiological action of the products of the bacillus, several attempts were made to obtain a poison from the bodies of the bacillus by growing these in broth, and removing the bodies by centrifugalisation, drying the bodies, after washing, over sulphuric acid, and keeping them in a dried state for two months or more. This dried powder kills a guinea-pig when subcutaneously injected within twenty-four hours, but death cannot be ascribed exclusively to the poison, inasmuch as the local lesion produced in the guinea-pig has always been found to contain the bacillus.

At present it has not been found possible to get a dried bacillus separate from its spores, but experiments are now being conducted with that object.

No. 4.

REPORT on the ACTION of the SPECIFIC AGGLUTININS formed by the BACILLUS COLI COMMUNIS, the TYPHOID BACILLUS, the PARATYPHOID BACILLUS, and the PROTEUS VULGARIS on each of these several Micro-organisms; by Dr. SIDNEY MARTIN, F.R.S.

The experiments here recorded were undertaken with the object of determining whether the agglutinins formed in the rabbit by each of the micro-organisms named had any effect on each of the other micro-organisms.

The physiological action in rabbits of the products of the four micro-organisms is apparently very similar, notably in the following particulars :—

1. The poisonous substance formed by the micro-organism is an endotoxin ; that is, in culture the poison exists chiefly in the bodies of the bacillus, from which it may be obtained by extraction. In the case of the typhoid bacillus and the bacillus coli communis but little toxin is excreted by the bacillus into the culture medium, whereas in the case of the proteus vulgaris an appreciable quantity is excreted in this way. The endotoxin of this micro-organism formed the subject of former reports.

2. The typhoid bacillus and the colon bacillus have but little digestive action on proteids, whereas the proteus vulgaris digests proteids and causes putrefaction.

3. When injected intravenously in rabbits the endotoxins of the typhoid bacillus, the colon bacillus, and the proteus vulgaris produce similar results—namely, in causing a great reduction in body temperature, and in producing a copious watery diarrhœa and the death of the animal, with great muscular weakness. This looseness of motions is due to a rapid pouring out of fluid into the large and small intestine.

Although the physiological action of the endotoxin in rabbits is apparently similar as regards all these micro-organisms, yet in its chemical life history the proteus vulgaris is widely separated from the typhoid bacillus and from the colon bacillus. Morphologically the paratyphoid bacillus lies midway between the typhoid bacillus and the colon bacillus.

All these micro-organisms give rise to agglutinins when their endotoxins are injected into animals. The agglutinin of the proteus vulgaris was the subject of report last year.

In the present investigation the rabbits were treated with a killed broth culture of each micro-organism, 1 cc. being injected subcutaneously in repeated doses, as shown in the Tables. A small dose of the poison was administered subcutaneously with the object of avoiding any serious illness in the animals. From

time to time portions of blood were removed from the ear of the rabbit thus inoculated and allowed to coagulate, the serum that was then separated from the clot being used for testing in various dilutions against the micro-organisms. Before the experiment was begun a small quantity of blood was removed from the animal and tested as regards its agglutinating power against the bacillus the endotoxin of which was to be injected. After the animal had been injected the serum of the blood removed was tested as regards its agglutinating power against each of the micro-organisms mentioned. The dilutions used were from 1 in 30 to 1 in 10,000. The following Tables show the results obtained :—

The marks indicating the reactions are as follows :—

+ = Complete reaction.

− = Negative reaction.

+ = A reaction nearly complete in one hour.

? = Doubtful reaction.

In each case the reaction was observed for one hour.

Table I.

Bacillus typhosus.—Rabbit weighing 2,150 grammes. Eight injections subcutaneously of killed B. typhosus broth culture; 1 cc. each dose.

—	*Serum Reaction.*						
	Control. Serum of Healthy Animal.	1 in 30.	1 in 100.	1 in 500.	1 in 1 000.	1 in 5,000.	1 in 10,000.
Before experiment		−	−				
	8 days, after two injections, each causing some rise of temperature.						
B. typhosus	−	+	+	+	+		
B. coli communis ..	−(?)		?	?			
B. paratyphosus ..		−	−	−			
Proteus vulgaris ..		−	−	−			
	21 days, after two more injections of 1 cc. each. Slight rise of temperature after each injection.						
B. typhosus	−		+	+	+	?	
B. coli communis ..	−	+	+	?			
B. paratyphosus ..	−	+	?	?			
Proteus vulgaris ..	−		−	−			

TABLE I.—(*cont.*).

—	*Serum Reaction.*						
	Control. Serum of Healthy Animal.	1 in 30.	1 in 100.	1 in 500.	1 in 1,000.	1 in 5,000.	1 in 10,000.
	35 days, after two more injections of 1 cc. each, causing slight rise of temperature.						
B. typhosus	—			+	+	—	—
B. coli communis ..	—	+	+	?			
B. paratyphosus ..	—	+	+	+			
Proteus vulgaris ..	—	—	—	—			
	49 days, after two more injections of 1 cc., causing very slight rise of temperature.						
B. typhosus	—		+	+	+	+	—
B. coli communis ..	?	+	?	—			
B. paratyphosus ..	—	+	+	+			
Proteus vulgaris ..	—	—	—				

TABLE II.

Bacillus coli communis.— Rabbit weighing 2,120 grammes. B. coli communis culture injected subcutaneously.

—	Control. Serum of healthy animal.	1 in 30.	1 in 100.	1 in 500.	1 in 1,000	1 in 5,000	1 in 10,000.
Before experiment		+	?				
	9 days, after two injections of 1 cc., causing slight rise of temperature.						
B. coli communis ..	—	+	+	+	+		
B typhosus	—	+	—	—			
B. paratyphosus ..		—	—	—			
Proteus vulgaris ..		—	—	—			
	50 days, after six more injections of 1 cc., temperature slightly raised after each injection.						
B. coli communis ..				+	+	?	—
B. typhosus		+	—	—			
B. paratyphosus ..		—	—	—			
Proteus vulgaris ..		—	—				

TABLE III.

Bacillus paratyphosus. — Rabbit weighing 1,770 grammes. Subcutaneous injection of broth culture of paratyphosus bacillus.

	Serum Reaction.						
	Control. Serum of Healthy Animal.	1 in 30.	1 in 100.	1 in 500.	1 in 1,000.	1 in 5,000.	1 in 10,000.
Before experiment		—	—				
	14 days, after three injections of 1 cc., causing slight rise of temperature.						
B. paratyphosus ..	—	+	+	+	—		
B. typhosus	—	+	?	—			
B. coli communis ..	—	+	+	—			
Proteus vulgaris ..	—	—	—				
	28 days, after one more injection of 1 cc., temperature not affected.						
B. paratyphosus ..	—		+	+	+	+	
B. typhosus	—	+	+	+			
B. coli communis ..	—	+	+	+			
Proteus vulgaris ..	—	—	—				
	42 days, after two more injections of 1 cc.						
B. paratyphosus ..	—		+	+	+	+	
B. typhosus	—		+	+			
B. coli communis ..			+	+	+		
Proteus vulgaris ..		—					
	56 days, after two more injections of 1 cc.						
B. paratyphosus ..	—		+	+	+	+	
B. typhosus	—		+	+	—		
B. coli communis ..	—	+	—	—	—		
Proteus vulgaris ..		—					

TABLE IV.

Proteus vulgaris.—Rabbit weighing 2,010 grammes. Subcutaneous injection of killed broth culture of Proteus vulgaris.

—	*Serum Reaction.*						
	Control. With Serum of Healthy Animal.	1 in 30.	1 in 100.	1 in 500.	1 in 1,000.	1 in 5,000.	1 in 10,000
Before experiment		—	--	—			
	19 days after, three injections of 1 cc., subcutaneously.						
Proteus vulgaris ..	—	+	+	+	+		
B. typhosus		—					
B. coli communis ..		—					
B. paratyphosus ..		—					
	35 days, after one more injection.						
Proteus vulgaris ..		—	+	+	+	+	+
B. typhosus	—	+	—				
B. coli communis ..		--	—				
B. paratyphosus ..		+ (?)					

The following conclusions may be drawn from the Tables :—

1. The agglutinin of the Proteus vulgaris, although very active against this micro-organism itself, has no action whatever against the typhoid bacillus, the colon bacillus, or the paratyphoid bacillus. The micro-organism therefore is widely separated from the other three micro-organisms, not only by its cultural and chemical characteristics but also by the agglutinin it forms in the living body.

2. The other three micro-organisms show some overlapping in their agglutinating reactions. Thus the agglutinin of the typhoid bacillus, formed after prolonged treatment of the animal, reacts slightly with the colon bacillus and with the paratyphoid bacillus. In most cases, however, the reactions are incomplete.

3. The agglutinin of the colon bacillus reacted very slightly with the typhoid bacillus, and not at all with the paratyphoid bacillus.

4. The agglutinin of the paratyphoid bacillus on the other hand reacted slightly with the typhoid bacillus, and perhaps more markedly, although somewhat irregularly, with the colon bacillus.

5. In higher dilutions this overlapping is not observed; in no case was there any overlapping in dilutions of of 1 in 5,000, and very rarely in dilutions of 1 in 1,000. Taking complete reactions, a dilution of 1 in 100 was as a rule sufficient to distinguish between the agglutinins.

No. 5.

REPORT on BACTERIAL TEST whereby PARTICLES SHED from the SKIN may be DETECTED in AIR; by DR. M. H. GORDON.

SCOPE OF THE INQUIRY.

My last report described the preliminary stages of an investigation undertaken to determine whether any micro-organisms occur habitually in close relation with the human epidermis in a fashion to afford adequate means for detecting in air particles of epidermis which may have become detached from man's body. In that investigation a preliminary examination of particles of skin and scurf from six normal individuals showed that the micro-organisms that developed in greatest number from one and all were staphylococci, and that in each instance the staphylococcus present in greatest abundance belonged to the category of Staphylococcus albus.

Having ascertained that the chief micro-organisms that developed in agar or broth cultures inoculated with particles either of skin or of scurf were staphylococci of the albus class, the next point to be determined was whether these staphylococci of skin and scurf respectively possess characters by which they can be differentiated in the first place from each other, and, secondly, from staphylococci albi of source other than dermal. It was clear that the latter differentiation was a necessary antecedent to the projected utilisation of the presence of these micro-organisms for the purpose of detecting particles of skin and scurf, and the fact that staphylococci of the albus class are by no means infrequent in air lent additional emphasis to this necessity of determining, before proceeding further, the relative differential value of the various characters of staphylococci at that time recognised as applicable for the purpose of distinguishing between them.

The virulence of sundry of the staphylococci of skin and scurf was tested on mice and on guinea pigs; but the result was negative. As regards staining reaction, the cocci in question were found to be without exception positive to Gram's stain. Comparison of the same and other staphylococci in respect of various morphological and cultural characters reputed to be of differential value showed that of the points examined, the two of most value for differential purposes in the present case were the growth in litmus-milk at 37° C. and on gelatine at 22° C. The differences between the staphylococci in question brought out by these two media were sharp and uniform, being in respect of acid-production and clot in litmus-milk, and in the case of gelatine, liquefaction. But though

of some distinguishing value, the differences between the staphylococci brought out by these two media alone were found to be quite insufficient for the object in view in the present instance.

As further and independent evidence of this insufficiency may be cited the fact that Welch, to whom the credit belongs of having been the first to point out that a particular staphylococcus which he named "Staphylococcus epidermidis albus" is habitually present on the skin, was nevertheless unable to absolutely differentiate this staphylococcus of the normal skin from Staphylococcus pyogenes albus. The only points of difference which he succeeded in detecting between the two staphylococci in question were that the skin staphylococcus clotted milk and liquefied gelatine rather more slowly than Staphylococcus pyogenes albus, and that it was also possessed of relatively feeble pathogenic capacity. From the latter circumstance Welch remarked that the designation "pyogenes" did not seem appropriate for this skin coccus, but he added that he was not inclined to insist too much upon this point "as very probably this coccus which has hitherto been unquestionably identified by Bossowski and others with the ordinary Staphylococcus pyogenes albus of Rosenbach is an attenuated or modified form of the latter organism, although, as already mentioned, it presents some points of difference from the classical description of the white pyogenic coccus" (American Journal of Medical Sciences, Boston, 1891, p. 458).

Before progress could be made, therefore, it was necessary to discover some further characters by which staphylococci in general, and staphylococci albi in particular, could be differentiated and identified. Accordingly a number of staphylococci were isolated from different sources and compared in respect of their action on a variety of substances. It is unnecessary here to give details of this portion of the inquiry as it has already been fully described in my last report. Suffice it to say that as a result of the investigation referred to seven further tests became applicable for the purpose of differentiating staphylococci. Altogether nine tests, therefore, were now available for this object. These nine tests were as follows :—

1. The question of the positive liquefaction of gelatine (12 per cent.) during a week at 22° C.
2. The clotting of litmus-milk in the same time at 37° C.
3. The peptonisation of the milk in the same time.
4. The reduction of nitrate to nitrite. This test is applied by cultivating the staphylococcus in broth containing 0·5 per cent. of nitrate of potassium, and by testing for nitrite after three days' incubation at 37° C.
5. The production of a change in the colour of neutral red broth in the course of two days anaerobically at 37° C.
6. The production during a week anaerobically at 37° C. of an acid reaction in slightly alkaline lemco litmus broth containing 1 per cent. of maltose.

7. Similar conditions, but with lactose.

8. Similar conditions, but with glycerine.

9. Similar conditions, but with mannite.

The formula for the lemco medium used in the last four tests is as follows :—

Lemco, 1 per cent.

Peptone, 1 per cent.

Sodium bicarbonate, 0·1 per cent.

Carbohydrate, or polyatomic alcohol, 1 per cent.

and 10 cc. per cent. of a 10 per cent. watery solution of ordinary solid litmus.

The above medium was devised by Dr. A. C. Houston. Previously I had been using ordinary broth freed from sugar by cultivating B. Coli therein for three days at 37°C. The lemco-broth has the advantage over the beef-broth, that it is cheaper and much more speedily and conveniently prepared, and, in addition, that its composition is constant when always made according to the above formula.

Having thus acquired a total of nine tests of approved value for the purpose of differentiating staphylococci, 50 micrococci of this type were isolated from various sources and submitted to the tests, with the result that they were distinguished into 28 different kinds. Forty-one of these staphylococci belonged to the albus class; they were differentiated into 23 kinds. Particulars of the sources and reactions of all the aforesaid staphylococci were included in my last report.

During the past year the main enquiry has been continued, and in the first place a large number of staphylococci, isolated by means of cultures, both aerobic and anaerobic, from the skins of normal persons, have been examined by the nine differential tests and classified. In this way, staphylococci present in cultures made from the skin of the hand, of the cheek, of the scalp and of the forearm have been investigated in the case of a variety of individuals of different age, sex, and degree. In all cases observation has been directed towards ascertaining the different kinds of staphylococci present, and, by observing the number of cases in which each kind was found, it has been possible to decide the question as to whether any particular kind or kinds of staphylococci are by reason of their habitual occurrence thereupon characteristic of the presence of particles of skin and of scurf.

Investigation was then made of the kinds of staphylococci occurring in air. First staphylococci were obtained from open air on occasions when no persons were in the immediate neighbourhood—that is to say, staphylococci were examined from air free, so far as could be managed, from particulate contamination derived from the human subject. In the second place, staphylococci were obtained from air indoors in rooms where persons

were gathered together—that is to say, staphylococci were examined from air possibly, or even probably, contaminated by particles derived from the surface of the bodies of those present.

In this way evidence has been obtained as to the feasibility of the proposed bacterial test for the detection in air of particles shed from the human integument.

Finally, a series of staphylococci isolated from various disease-processes have been submitted to the nine differential tests, and their behaviour with regard to these determined.

Procedure.

1. *Examination of the Hand and Cheek.*

A sterile swab was slightly moistened with sterile salt solution, and gently rubbed over about one square inch of the surface of the skin. The swab was next lightly rubbed over the surface of two agar plates in succession, and then dipped into a broth tube. Both agar and broth cultures were incubated at 37° C., the former aerobically, and the latter anaerobically. After 48 hours, colonies of the various types of staphylococci present were subcultured from the agar plates, and from the anaerobic broths agar plate cultures were made, and the various staphylococci that might be present in the broth in this way isolated in pure culture.

2. *Scalp and Forearm.*

Epidermal scales, removed in each case by scraping with a sterile knife, were distributed in a tube of sterile salt solution. From the latter, agar and broth cultures were made as before. In a proportion of the scurf examinations an additional broth culture was made and incubated aerobically.

3. *Air.*

Agar plates were exposed for a definite period and then incubated at 37° C. In cases where broth plates were used, the broth was exposed in small flat aluminium dishes about 3½ inches in diameter, and fitted with lip and short handle. Before use these dishes were wrapped in paper, placed in a metal box, and the whole then thoroughly sterilized in the hot-air steriliser. Further details with regard to the form of apparatus used in these experiments are afforded in the accompanying illustrations.

Results.

As staphylococci were by far the most abundant and constant micro-organisms met with in cultures from the skin, attention has been confined to them. On a few occasions rapidly growing bacilli of the mesentericus type developed on the agar plates, and

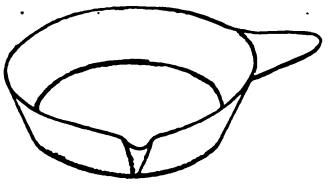

FIG. 1.

Form of metal dish found most convenient for the purpose of exposing broth to the air.

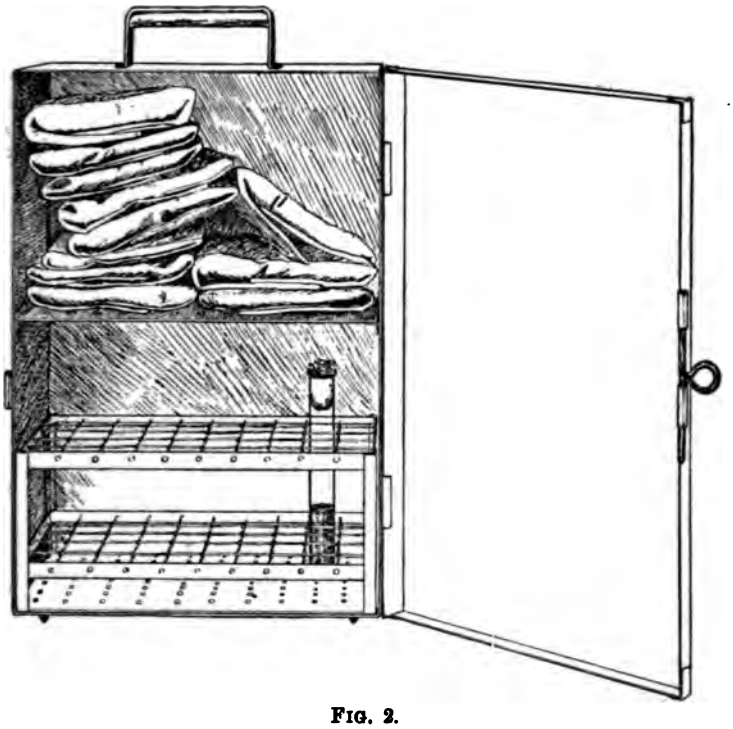

FIG. 2.

Metal box for carrying materials for making broth plates. In the upper partition are the metal dishes which are wrapped in paper before sterilisation.

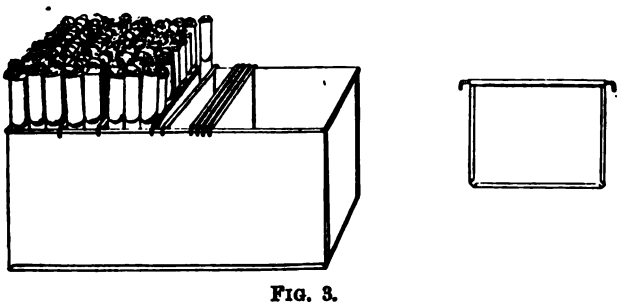

FIG. 3.

Metal box with sliding removable partitions used when examining the action of micro-organisms on various sugars, &c. This form of apparatus, which fits easily into the incubator, has been found indispensable when subjecting a large number of micro-organisms to the tests. By using a glass pencil in place of an adhesive label and by placing all subcultures of the same micro-organism in one partition much time is saved.

also in a few cases bacilli of the diphtheroid type, but as both these micro-organisms were rare, they were discarded. The one striking and uniform feature of the cultures throughout has been the large number of colonies of staphylococci that developed, and on them alone therefore attention has been concentrated.

It is be noted that in the majority of cases staphylococci were comparatively far more numerous in cultures made from the cheek than in cultures made from the hand; no doubt because as a rule the hands are more frequently washed.

1. *Gram's Stain.*

In the course of the present enquiry the characters of between 300 and 400 staphylococci have been investigated. All of these staphylococci were tested with Gram's stain, and in every case the result was positive; that is to say, the stain was retained by the coccus. It should be mentioned that seven of the staphylococci when first examined with Gram's stain gave what was thought at the time to be a negative result, *i.e.*, the coccus was destained; but in all these cases a second trial proved that with greater care and a younger culture these seven staphylococci were one and all really positive to Gram. I mention this point, because it illustrates the facility with which, without due care, mistakes may in some cases be made with this exceedingly valuable staining test. Considerable recent experience of Gram in which the stain was applied to over 100 cultures of truly Gram-negative cocci, comprising six different kinds, has convinced me of the fundamental value of this test for distinguishing at once and effectively Gram-negative cocci from the far commoner cocci that give a positive reaction to Gram. But to be of differential value, this staining test must always be applied in the same way; and if the result is at all doubtful, controls should be instituted with view to ensuring that the method is being properly applied, and then the test should be repeated. My experience up to the present is that in cases where the first examination of a coccus with Gram gives a result that is doubtful, further testing with controls shows the coccus to be positive; whereas in the case of truly Gram-negative cocci, there is no doubt whatever from the first of their failure to hold the stain.

2. *Morphology when cultivated in broth for* 48 *hours at* 37° *C.*

Micrococci are generally classed under one of three heads, the criterion being the direction in space in which they divide. Thus cocci that divide solely in one direction, and for that reason often form chains, are termed streptococci; cocci that divide in two directions are termed staphylococci; and cocci that form cubes by dividing in three planes each at right angles to the other are termed sarcinæ. A way of roughly describing the staphylococcus group is to say that it includes all those micrococci that are neither streptococci nor sarcinæ.

Broth is an excellent medium in which to examine this matter of the "bearing" of the growth of a coccus, and accordingly in the present enquiry, as throughout my former investigations of micrococci, all micro-organisms investigated have in the first place been submitted to microscopical examination when growing in this medium.

In my former investigations, in which streptococci were under observation, there was seldom so far as I can recall much difficulty in relegating any of the large numbers of cocci examined to the streptococcus group immediately a cover glass preparation of its growth in broth was placed under the microscope, the term streptococcus being an exceptionally apt one for the chain cocci then dealt with. In the present investigation, however, in which another class of coccus altogether has been under examination, a difficulty arose at the outset because it was found that, as regards microscopical appearance of the growth in broth, the best known and therefore in one sense the most "typical" staphylococci, viz., the pyogenetic staphylocci aureus and albus, do not form nearly such good groups in broth as do some other staphylococci which occur in nature. As a matter of fact all the pyogenetic staphylococci of which up to the present time I have been able to obtain cultures have without exception rendered broth uniformly turbid; and microscopically, so far from being gathered into clumps, these cocci have been found to be dispersed uniformly throughout the medium occurring chiefly as diplococci and single cocci. On the other hand, in the course of the present investigation numerous examples have been met with of cocci that leave broth almost if not quite clear, and grow therein chiefly or even entirely in groups. To the latter class of coccus the term staphylococcus (Σταφυλη, a bunch of grapes) is far more suitable than to the former.

In order to mark this difference between the appearance of the growth of the two classes of staphylococcus in broth I have provisionally labelled cocci that belonged to the former type, *i.e.*, that rendered broth turbid and were found microscopically to be dispersed throughout that medium, type A.; while staphylococci that left the broth relatively or even absolutely clear and grew therein in groups I have labelled type B. In the tables therefore giving the characters of the various staphylococci met with in the present enquiry the letter A. or B. in the column devoted to the growth in broth signifies to which of these two types a given coccus belonged.

It should also be mentioned that staphylococci belonging to type A. and making broth uniformly turbid, were in many cases observed to be much smaller than staphylococci belonging to type B.

In some cases, notably in that of a staphylococcus found to be particularly abundant in scurf the broth was apt to be rendered somewhat turbid, but microscopically, though a certain proportion of single or diplococci were dispersed through the medium, a large number of the cocci were also grouped in

bunches. The two letters A.-B. have been employed in the broth column to signify that a coccus belonged to this intermediate class.

Whilst dealing with the matter of morphology in broth it is well to mention another point. On several occasions I have met with cocci that belonged to type B., but showed a marked tendency to form tetrads. So marked may this tendency be in some cases as to raise a doubt whether the coccus is not really a sarcina I have, however, throughout, limited the term sarcina to those cube-forming cocci in the growth of which division in the third plane was so obvious that there could be no doubt about it A further distinguishing feature of the sarcinæ met with in the present enquiry was that not one of them produced an acid reaction in the case either of the two sugars or of the two polyatomic alcohols against which all the cocci have been tested. This negative feature of sarcinæ would seem to distinguish them in a marked degree from most of the staphylococci and streptococci. It remains, however, to be seen if all sarcinæ behave in the same manner as those specimens at present tested.

3. *Colour of the growth on agar.*

This matter was observed during cultivation of the coccus on agar for a week ærobically at 37° C.

4. *Behaviour of the staphylococci in the nine differential tests.*

All the cocci met with in the present enquiry have been submitted to these nine tests, and tabulated according to the result. Particulars of the nine tests and of the method of applying each of them have been already given.

In the tables showing the response yielded by staphylococci to these tests it will be observed that one of the tests, viz., the question of the peptonisation of milk, has not a column devoted to it in the present series. The reason of this omission is because the staphylococci examined in the present enquiry almost all failed to produce definite peptonisation of the milk. In the few cases in which such peptonisation was observed, therefore, that fact is indicated by the letter P. in the column devoted to the question of the clotting of milk.

APP. B, No
Report on
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detected in
by Dr. Gord

PART I.

STAPHYLOCOCCI OF THE SKIN.

1. *Staphylococci of the Hand.*

(A). Number of cases examined.

Cultures were made from the hands of 20 different persons, 17 samples of epidermis being examined by agar plates, and 15 by anaerobic broth cultures.

(B). Kinds of Staphylococci differentiated.

Altogether 57 cocci were obtained in this way from the skin of the hand and submitted to the differential tests, with the result that 23 kinds were distinguished. The characters of all these cocci are seen in the following table.

Characters of Staphylococci obtained from the Hand.

No.	Broth.	Agar.	Specimens.	No. of cases from which obtained.	Clot in milk.	Liq. Gel.	N. red.	Nitrite.	Maltose.	Lactose.	Glycerin.	Mannite.	Positive Characters.
1	Sarcina	White	2	2	-	-	-	-	-	-	-	-	0
2	Do.	Do.	4	2	-	+	-	-	-	-	-	-	1
2	Type B. tetrads.	Do.	2	2	-	-	-	-	-	+	-	-	
4	Do.	Do.	7	4	-	-	-	-	+	+	-	-	2
5	Type A.	Yellow	2	2	-	-	-	+	+	-	-	-	
6	A.	White	1	1	-	+	-	-	+	+	-	-	3
7	B	Do.	1	1	-	-	-	+	+	+	-	-	
8	B.	Do.	1	1	-	-	-	-	+	+	+	-	
9	A.	Do.	1	1	-	-	-	-	+	-	+	+	
10	B. tetrads.	Do.	2	2	-	-	-	+	+	+	+	-	4
11	A.	Yellow	1	1	-	+	-	+	+	+	-	-	
12	B.	White	1	1	-	+	-	-	+	+	-	+	
13	A.	Do.	1	1	-	-	-	-	+	+	+	+	
14	A.	Yellow	2	2	-	+	+	-	+	+	+	-	5
15	A.	White	1	1	-	+	+	+	+	+	-	-	
16	A.	Do.	1	1	-	+	-	-	+	+	+	+	
17	A. tetrads.	Do.	1	1	-	-	-	+	+	+	+	+	

Characters of Staphylococci obtained from the Hand—cont.

No.	Broth.	Agar.	Specimens.	No. of cases from which obtained.	Clot in Milk.	Liq. Gel.	N. red.	Nitrite.	Maltose	Lactose.	Glycerin.	Mannite.	Positive Characters.
18	A.	White.	1	1	+	-	+	+	+	+	+	-	6
19	A.	Do.	5	4	-	+	+	+	+	+	+	-	
20	A.	Do.	15	14	+	+	+	+	+	+	+	-	7
21	A.	Yellow	1	1	+	+	-	+	+	+	+	+	
22	A.	Do.	3	3	-	+	+	+	+	+	+	+	
23	A.	White	1	1	+	+	+	+	+	+	+	+	8

(C). Kinds of staphylococci most frequently found.

It is seen from the above table that the staphylococci met with most frequently in cultures from the hand were as follows :—

Frequency.	Broth.	Agar.	Specimens.	No. of cases from which obtained.	Clot in Milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose.	Lactose.	Glycerin.	Mannite
1	A.	White	15	14	+	+	+	+	+	+	+	-
2	B. tetrads.	Do.	7	4	-	-	-	-	+	+	-	-
3	A.	Do.	5	4	-	+	+	+	+	+	+	-

No. 1. The first of these three staphylococci was obtained far more frequently than any of the others, having been cultivated from 14 of the 20 hands examined. The staphylococcus in question belonged to type A. as regards growth in broth, formed a thick white growth on agar, and gave a positive response to seven of the tests.

As regards the media by means of which it was isolated from the skin of the hand, it is noteworthy that of the 17 cases examined by agar plates, only four yielded this staphylococcus, whereas of the 15 cases examined by anaërobic broth cultures no less than 10 gave a positive result with regard to it.

No. 2. The micro-organism second in point of frequency was much rarer than the preceding coccus, having been obtained from only four of the 20 cases. The present coccus belonged to type B. in broth and showed a marked tendency to form tetrads; indeed, for this reason, I have sometimes suspected the coccus to be a sarcina, but up to date I have not been able to detect

division in the third plane. This coccus gave a much slower growth on agar than the first, and when examined by the differential tests gave a positive response to two of them only viz., maltose and lactose.

In all the cases in which this coccus was found it appeared on the agar plate. It was never found in the anaërobic broth cultures.

No. 3. This staphylococcus, equal to No. 2 in frequency, was identical in all respects but one with staphylococcus No. 1. The only difference between them was that staphylococcus No. 3 failed to clot milk.

2. *Staphylococci of the Cheek.*

(A). Number of cases examined.

Cultures were made from the skin of the cheek in the case of 20 different individuals. In all instances agar plates were made, and in 15 of the 20 samples cultures were made in anaërobic broth as well.

(B). Kinds of staphylococci differentiated.

The 97 staphylococci isolated from the cheek were submitted to the several tests and thereby differentiated into 31 kinds. The characters of these cocci are seen in the following table.

Characters of Staphylococci obtained from the Cheek.

No.	Broth.	Agar.	Specimens.	No. of cases from which obtained.	Clot in Milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose.	Lactose.	Glycerin.	Mannite.	Positive Characters.
1	Sarcina	White	4	2	-	-	-	-	-	-	-	-	0
2	Do.	Yellow	1	1	-	-	-	-	-	-	-	-	
3	Do	White	2	2	-	+	-	-	-	-	-	-	1
4	A.	Do.	1	1	-	-	-	+	-	-	-	-	
5	B. tetrads	Do.	1	1	-	-	-	-	+	-	-	-	
6	Sarcina	Do.	2	1	-	+	-	+	-	-	-	-	2
7	B.	Do.	1	1		+	-	-	+	-	-	-	
8	B.	Do.	3	3	-	-	-	+	-	-	-	+	
9	B.	Do.	12	8	-	-	-	-	+	+	-	-	
10	B.	Yellow	1	1	-	-	-	-	+	-	-	+	

Characters of Staphylococci obtained from the Cheek—cont.

No.	Broth.	Agar.	Specimens.	No. of cases from which obtained.	Clot in milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose.	Lactose.	Glycerin.	Mannite.	Positive Characters
11	B.	White	1	1	-	+	-	-	+	-	-	+	3
12	B.	Do.	2	1	-	-	+	-	+	+	-	-	
13	B.	Do.	1	1	-	-	-	+	-	-	+	+	
14	B.	Do.	1	1	-	-	-	-	+	-	+	+	
15	A.	Do.	1	1	-	+	+	-	+	-	+	-	4
16	B.	Do.	3	2	-	-	-	+	+	+	+	-	
17	A	Yellow	3	2	-	-	-	+	+	+	-	+	
18	A.	White	1	1	-	+	-	+	+	-	+	+	5
19	A.	Do.	1	1	-	+	-	-	+	+	+	+	
20	A.	Yellow	1	1	-	-	+	+	+	-	+	+	
21	A.	White	2	1	-	-	+	+	+	+	+	-	
22	A.	Do.	2	2	-	-	-	+	+	+	+	+	
23	A.	Do.	10	5	-	+	+	+	+	+	+	-	6
24	A.	Do.	1	1	-	+	+	+	+	+	-	+	
25	A.	Yellow	3	2	-	+	-	+	+	+	+	+	
26	A.	White	2	2	-	-	+	+	+	+	+	+	
27	A.	Do.	29	17	+	+	+	+	+	+	+	-	7
28	A.	Do.	1	1	P	+	+	+	+	-	+	+	
29	A.	Yellow	3	1	-	+	+	+	+	+	+	+	
30	A.	Do.	2	2	+	+	+	+	+	+	+	+	8
31	A.	Do.	1	1	P	+	+	+	+	+	+	+	

Note.—P in the milk column signifies peptonisation of the milk.

(C). Kinds of staphylococci found most frequently.

The three kinds of staphylococci met with most frequently in cultures from the cheek were as follows :—

Frequency.	Broth.	Agar.	Specimens.	No. of cases from which obtained.	Clot in Milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose.	Lactose	Glycerin.	Mannite.
1	A.	White	29	17	+	+	+	+	+	+	+	-
2	B.	Do.	12	8	-	-	-	-	+	+	-	-
3	A.	Do.	10	5	-	+	+	+	+	+	+	-

No. 1 This staphylococcus was obtained far more often than any of the others, having been cultivated from 17 of the 20 cases examined.

The characters of this staphylococcus are seen to be identical with those of the staphylococcus found present most frequently in cultures from the hand.

As regards media by means of which it was isolated from the skin of the cheek, it may be said that this staphylococcus was found present in the agar plate in 11 of the 20 cases examined by this medium, and that it was also isolated from 11 of the 15 anaërobic broth cultures. In three of the latter cases it was absent on the agar plate, but present in the broth.

No. 2. This coccus was much less frequent than the first, having been obtained from eight of the 20 cases.

The characters of this coccus are identical with those of the coccus found to be second in frequency on the hand.

As in the case of the hand, all the present examples of this coccus were obtained by agar plate.

No. 3. The coccus, third in point of frequency, was obtained from five of the 20 cases.

Its characters are identical with those of the coccus third in frequency on the hand.

3. *Staphylococci of the Scalp.*

(A). Number of cases examined.

Particles of scurf were examined from 20 individuals. In all cases surface agar plate-cultures were made. In addition 11 of the samples were examined by anaërobic broth, and 14 by aërobic broth.

(B). Types of staphylococci differentiated.

One hundred and sixteen stapylococci isolated from the cultures were differentiated into 28 kinds. The characters of all these micro-organisms are seen in the following table:—

Characters of Scurf Staphylococci.

No.	Broth.	Agar.	Specimens.	No. of cases from which obtained.	Clot in milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose	Lactose.	Glycerin.	Mannite.	Positive Characters.
1	Sarcina	White	3	2	–	–	–	–	–	–	–	–	0
2	A.-B.	Do.	1	1	–	–	–	–	–	–	–	+	1
3	A.-B.	Do.	21	11	–	–	–	+	–	–	–	–	
4	A.-B.	Do.	22	12	–	–	–	+	–	–	–	+	2
5	B.	Do.	1	1	–	–	–	–	+	+	–	–	
6	A.	Yellow	1	1	+	+	–	+	–	–	–	–	3
7	A.	White	1	1	–	+	+	–	–	–	+	–	
8	A.	Do.	1	1	–	+	–	+	–	–	–	+	
9	B.	Do.	1	1	–	–	+	+	+	–	–	–	
10	A.	Do.	2	2	–	–	+	–	+	+	–	+	
11	B.	Yellow	1	1	–	–	–	+	+	–	+	–	
12	A.-B.	White	6	3	–	–	–	+	–	–	+	+	
13	B.	Do.	1	1	–	–	–	–	+	+	+	–	
14	A.	Do.	1	1	–	+	–	+	+	–	+	–	4
15	B.	Yellow	2	1	–	–	–	+	+	+	+	–	
16	B.	White	1	1	–	–	–	+	+	–	+	+	
17	A.	Do.	1	1	+	–	–	+	+	+	+	–	5
18	A.	Do.	2	2	–	+	+	+	+	–	+	–	
19	B.	Do.	3	1	–	–	–	+	+	+	+	+	
20	A.	Do.	6	4	+	+	–	+	+	+	+	–	6
21	A.	Do.	1	1	+	–	+	+	+	+	+	–	
22	A.	Do.	1	1	+	–	+	+	+	–	+	+	
23	A.	Do.	13	9	–	+	+	+	+	+	+	–	
24	A.	Yellow	2	2	–	+	–	+	+	+	+	+	
25	A.	White	1	1	–	+	–	+	+	+	+	+	
26	A.	Do.	18	12	+	+	+	+	+	+	+	–	7
27	A.	Yellow	1	1	+	+	–	+	+	+	+	+	
28	A.	White	1	1	–	+	+	+	+	+	+	+	

(C). Kinds of staphylococci most frequently found.

The kinds of staphylococci obtained most frequently from the scalp were as follows :—

Frequency.	Broth.	Agar.	Specimens.	No. of cases from which obtained.	Clot in Milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose.	Lactose.	Glycerin.	Mannite.
1 {1a ..	A.-B.	White	22	12	−	−	−	+	−	−	−	+
{1b ..	A.	Do.	18	12	+	+	+	+	+	+	+	−
3	A.-B.	Do.	21	11	−	−	−	+	−	−	−	−
4	A.	Do.	13	9	−	+	+	+	+	+	+	−

It appears, therefore, that two kinds of staphylococci were obtained with equal frequency from the scalp; each of them having been isolated from 12 of the 20 cases examined.

No. 1*a*. This staphylococcus was isolated from the agar plate in 10 out of 20 cases examined by this medium, and in some of these positive plates it was the micro-organism present most abundantly of all on the plate. It was isolated from one out of the 11 anaërobic broth cultures, and from three out of the 14 aërobic broth cultures.

As regards its growth in broth, the coccus was intermediate between types A. and B.—the broth being rendered turbid while microscopically the tendency to form groups was marked.

In the differential tests this staphylococcus gave only two positive reactions, viz., in the nitrite and mannite tests. The negative reaction of this coccus in maltose is particularly distinctive.

No. 1*b*. Equally frequent with the preceding coccus in regard to the proportion of cases from which it was recovered, this staphylococcus is, as is seen from its reactions, identical with the staphylococcus recovered most frequently from the skin of the hand and cheek. It was recovered from the agar plate in three of the 20 cases examined by that method; in four out of 11 cases examined by anaërobic broth, and in 10 out of 14 examined by aërobic broth.

No 3. The staphylococcus third in frequency was almost as common as the preceding two. It was found to be identical with No. 1*a* of this series in all respects, save that it failed to produce a positive reaction in mannite. In all cases from which it was isolated this coccus was recovered from the agar plate.

No. 4. The staphylococcus fourth in frequency was identical with staphylococcus No. 1*b* in all respects, save that it failed to clot milk. It was isolated three times from the agar plates, four times from the anërobic broth, and three times from the aërobic broth.

4. *Staphylococci of the Forearm.*

In order to ascertain the nature of the micro-organisms present on the skin of an unexposed part of the body, flakes of epidermis were scraped off the forearms of six individuals and cultures made therefrom both on surface agar plates and in anaerobic broth.

In all cases the micro-organisms that developed in greatest number were staphylococci, of which altogether seven different kinds were obtained. Their characters are seen in the following table :—

Characters of Staphylococci from the Forearm.

No.	Broth.	Agar.	Specimens.	No. of cases from which obtained.	Clot in Milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose.	Lactose.	Glycerin.	Mannite.	Positive Characters.
1	Sarcina	White	1	1	-	-	-	-	-	-	-	-	0
2	B.	Do.	1	1	-	-	-	-	+	-	-	-	1
3	B.	Do.	1	1	-	-	-	-	+	-	+	-	2
4	B.	Do.	4	2	-	-	-	+	-	-	+	+	3
5	A.	Do.	1	1	-	-	+	+	+	-	+	-	4
6	B.	Do.	1	1	-	+	-	+	+	+	-	+	5
7	B.	Do.	2	1	-	+	+	+	-	+	+	+	6
8	A.	Do.	8	6	+	+	+	+	+	+	+	-	7

The staphylococcus obtained most frequently from the skin of the forearm, therefore, was identical with the staphylococcus obtained more frequently than any other from the skin of the other parts of the body previously examined. In the present case this staphylococcus was found in two out of the six agar plates, but in all of the six anaerobic broth cultures.

SUMMARY.

The micro-organisms that occur most frequently on the normal skin, whether of the hand, of the cheek, of the scalp, or of the forearm, are staphylococci of the albus class. By means of the differential tests described in my last report, these staphylococci have been recognised as comprising a large number of distinguishable kinds. It has been found, however, that the staphylococcus that occurs most frequently on the skin of the hand, forearm, and cheek, has in each instance identical characters. The staphylococcus in question gives a positive response to seven of the nine differential tests, the two negative reactions being in regard to the acidification of mannite and the peptonisation of milk.

The flora of the scalp appears to differ somewhat from that of other parts of the skin of which examination has been made, in that cultures made from scurf yielded two different kinds of staphylococci which greatly exceeded others in frequency. One of these staphylococci possessed characters identical with those of the staphylococcus found most frequently on the skin of the hand, forearm, and cheek. The other staphylococcus, however, was of quite a different order; for instead of two negative reactions only in the nine tests, this staphylococcus of scurf only reacted positively to two. The positive reactions in question were effected by the coccus in the nitrite and mannite tests. It should be mentioned that negative reaction in maltose is particularly distinctive of this coccus.

Staphylococci that may be regarded as varieties of each of the two preceding micro-organisms were also found. Staphylococcus No. 3 in the table next below was identical with staphylococcus No. 1 of the general series in all respects save the clotting of milk; and staphylococcus No. 4 was identical with the second staphylococcus of the table in everything except that it failed to produce an acid reaction in mannite.

A coccus that gave positive reactions in maltose and lactose alone was second in frequency in cultures from the cheek and hand. The characters of this and the preceding staphylococci are summarised in the following table :—

Showing the characters and degree of frequency of the Staphylococci recovered most often from the Skin.

Number.	Characters.										Frequency.								Remarks.
											Hand.		Face.		Scalp.		Fore-arm.		
	Type of Broth.	Colour of Agar.	Clot in Milk.	Liq. Gelatine.	N. Red.	Nitrite.	Maltose.	Lactose.	Glycerin.	Mannite.	Cases examined.	Cases positive.	Cases examined.	Cases positive.	Cases examined.	Cases positive.	Cases examined.	Cases positive.	
1	A.	White	+	+	+	+	+	+	+	-	2	14	20	17	20	12	6	6	Most characteristic of all of skin.
2	A.-B.	Do.	-	-	-	+	-	-	-	+	20	0	20	0	20	12	6	0	Particularly characteristic of scurf.
3	A.	Do.	-	+	+	+	+	+	+	-	20	4	20	5	20	9	6	0	Variety of No. 1.
4	A.-B.	Do.	-	-	-	+	-	-	-	-	20	0	20	0	20	11	6	0	Variety of No. 2.
5	B.	Do.	-	-	-	-	+	+	-	-	20	4	20	8	20	0	6	0	Second in frequency on hand and cheek

part on
dermal. That
nearly
distributed
on the skin
of the
remaining
parts of
the body.

Conclusions.

Although a variety of staphylococci occur on the skin, one staphylococcus in particular, having uniform and definite characters, characters of such a nature as to permit of its ready distinction from other staphylococci, occurs thereon far more frequently than any other. This micro-organism frequents the epidermis of the hand, cheek, scalp, and forearm with such persistency that it may be considered characteristic thereof in much the same way that B. coli is characteristic of the large intestine and Streptococcus brevis of the mouth.

As there is reason to believe that this staphylococcus is identical with the staphylococcus observed by Welch to occur habitually on the skin, and for that reason named by him Staphylococcus epidermidis albus, this name will hereafter be retained for it. But I would insist that it should be clearly understood what kind of staphylococcus is implied by the name *Staphylococcus epidermidis albus*; that unless a given staphylococcus has been tested and proved to possess *all* the characters found in the present investigation to be differential attributes of this staphylococcus most frequently present on the skin, the name Staphylococcus epidermidis albus should *not* be applied to it.

As Staphylococcus epidermidis albus possesses characters by dint of which it can be distinguished from other staphylococci, its presence may serve for the purpose of detecting bacteriologically the presence of particles shed from the skin of the hand, forearm, cheek, and scalp.

Although Staphylococcus epidermidis albus is by far the most frequent micro-organism on the skin of the above parts, and, therefore, probably of the skin of other parts of the body,* another and different staphylococcus is equally, if not more, abundant on the skin of the scalp. The scurf staphylococcus in question possesses characters by which it can readily be differentiated from other staphylococci, and it may therefore be regarded as particularly serviceable in detecting the presence of particles of scurf.

* In order to obtain evidence as to this matter, I recently obtained three samples of bath water in which the whole body had been immersed, and tested the abundance therein of staphylococcus epidermidis albus. In each case a different individual had had a hot bath, and had used soap. In two of the samples this skin staphylococcus was present to between 1,000 and 10,000 per c.c. of the bath water. In the third sample of bath water this micro-organism was found present to over 10,000, but under 100,000 per c.c. It may, I think, be inferred from these observations that Staphylococcus epidermidis albus is characteristic of the whole of the skin, and not only of those parts of it which were specially investigated in the present inquiry mainly for the reason that they are parts of the skin generally exposed to the air.

Report on Bacterial Test whereby Particles shed from the Skin may be detected in Air by Dr. Gordon

PART II.

Staphylococci of the Air.

Having obtained in the fashion which I have described a bacterial test by means of which particles detached from the surface of the human skin could be identified among other matter, the next step was to investigate the value of this test for the purpose of detecting the presence of such particles in air.

The primary culture media used throughout the preceding investigation of the bacteria of the skin were agar and broth, and, after inoculation, both were incubated at 37° C., the agar aërobically, the broth anaërobically. Similarly, in this second phase of the enquiry use has been made of these same two media by exposing dishes containing them to the air, and by then, after incubation, searching them for the presence of those particular micro-organisms previously ascertained to denote the presence of particles of skin and scurf.

The index micro-organisms referred to being staphylococci, the investigation has resolved itself into a scrutiny of the characters of staphylococci obtained, first, from the open air, and, secondly, from the air of inhabited rooms.

Open Air.

On each of three occasions staphylococci have been obtained from the open air by exposing six agar plates for half-an-hour and subsequently incubating them at 37° C. In this way investigation has up to the present been made of air in places situate in three different districts of the metropolis, viz., in London, E.C., S.W., and S.E., respectively. In the case in which the open air was examined in the E.C. district, the plates were exposed at a height 60 feet above the level of the street below; but in both the other tests of open air, the plates were exposed at the ground level. On none of the three occasions when these tests were made was the wind strong, and, with the exception of the observer, who took care to approach the plates from the leeward side, no person was in the immediate vicinity while the plates were being exposed to the air.

After incubation, it was found on all three occasions, that a proportion of the plates were overgrown by rapidly-growing bacilli of the B. mesentericus type. In the remaining plates, colonies of bacilli of the B. subtilis class were numerous; but a fair number of colonies of staphylococci also developed, and all of these were sub-cultured and examined. The results given by these staphylococci in the differential tests are recorded in the following table, from which it is seen that although a total of 15 different kinds of staphylococci were obtained

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from the open air, no single one of them could be identified with staphylococci characteristic of skin or of scurf.

Characters of Staphylococci obtained from the Open Air of London, E.C., S.E., and S.W.

No.	Broth.	Agar.	Specimens.	No. of cases from which obtained.	Clot in Milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose.	Lactose	Glycerin.	Mannite.	Positive Characters
1	Sarcina	White	1	1	-	-	-	-	-	-	-	-	0
2	B.	Yellow	1	1	-	+	-	-	-	-	-	-	1
3	B.	White	5	2	-	-	-	-	+	-	-	-	
4	B.	Do.	1	1	-	-	+	-	+	-	-	-	2
5	B.	Do.	3	2	-	-	-	+	+	-	-	-	
6	B.	Do.	1	1	-	-	-	-	+	-	+	-	
7	B.	Yellow	1	1	P	+	-	-	+	-	-	-	3
8	A.-B.	White	1	1	-	-	-	+	+	+	-	-	
9	B.	Do.	1	1	-	-	-	-	+	+	+	-	
10	A.-B.	Do.	1	1	-	+	-	+	+	-	+	-	4
11	A.-B.	Do.	1	1	-	+	-	+	+	+	-	+	5
12	A.	White agar; yellow, gelatine.	2	1	-	+	-	+	+	-	+	+	
13	A.	White	1	1	-	-	-	+	+	+	+	+	
14	A.-B.	White, agar; yellow, gelatine.	1	1	-	+	-	+	+	+	+	+	6
15	A.	White	1	1	+	+	+	+	-	+	+	+	7
16	A.	Yellow	1	1	+	+	+	+	+	+	+	+	8

Air Indoors.

1. Air of a Barber's Shop.

The following experiment was made by exposing four agar plates in a barber's shop. The chief operation in progress during the experiment was shaving. The plates were exposed on a shelf about the level of the heads of the customers, but

between three and four feet distant. The exposure given was half-an-hour, which was found afterwards to have been too long, as two of the plates were so crowded with colonies that they had to be discarded. Seventeen staphylococcus-like colonies were however sub-cultured from the remaining two plates and examined with the result that 15 different kinds were distinguished.

The characters of these staphylococci are recorded in the following table, from which it will be seen that one of the 15 staphylococci was identical with Staphylococcus epidermidis albus.

Characters of Staphylococci from Air of a Barber's Shop.

No.	Broth.	Agar.	Specimens.	Clot in Milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose.	Lactose.	Glycerin.	Mannite.	—
1	Sarcina	White	1	–	–	–	–	–	–	–	–	
2	A.-B.	Do.	1	–	+	–	–	–	–	–	–	
3	B.	Do.	..	–	–	–	–	+	–	–	–	
4	B.	White, agar; yellow, gelatine.	..	–	–	–	+	+	–	–	–	
5	B.	White	..	–	+	–	–	+	+	–	–	
6	A.	Do.	..	–	+	–	–	+	–	+	–	
7	A.	Do.	..	–	+	+	–	+	–	+	–	
8	B.	Do.	2	–	+	–	–	+	+	+	–	
9	B.	Do.	1	–	–	+	+	+	+	–	–	
10	B.	Do.	1	–	+	+	+	–	+	+	–	
11	B.	Do.	..	–	+	–	+	+	+	+	–	
12	A.	Do.	..	–	+	–	+	+	+	+	+	
13	A.	Do.	..	+	+	+	+	+	+	+	–	Staph. epiderm. albus.
14	A.	Yellow	..	+	+	–	+	+	+	+	+	
15	A.	Do.	..	+	+	+	+	+	+	+	+	

2. Air of an Operation Theatre.

The next two observations form part of an investigation which I have been making in conjunction with Mr. G. Gask, F.R.C.S., on the subject of the kinds of bacteria met with in the air of an operation theatre during use.

On each of the two occasions to which I am referring, the medium employed was neutral red broth, which, after exposure, was incubated anaërobically at 37° C. In both cases control tests

were made by exposing dishes of the same medium to the air of the theatre immediately before use. All the dishes, both in the control tests and in the others, were exposed for one hour.

The results were as follows: On both occasions the control broths failed to yield staphylococci. On the other hand, the broths exposed while the theatre was in use yielded in each instance staphylococci, and from one plate in each of these two observations a staphylococcus was recovered which was identified with Staphylococcus epidermidis albus.

About 16 persons were present in the theatre on each of the occasions when it was in use. In the control tests the theatre was mostly empty, but during part of the time two nurses were preparing the theatre for use. I may add that the operating theatre in question is of comparatively recent date, and that every care is taken to keep it clean and, so far as circumstances permit, aseptic.

Characters of Staphylococci from Air of an Operation Theatre.

No.	Broth.	Agar.	Specimens.	Broth-plates from which obtained.	Clot in Milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose.	Lactose.	Glycerin.	Mannite.	—
Test I.													
1	A.	White	2	2	-	-	+	+	+	-	+	-	
2	A.	Do.	3	3	-	+	+	-	+	-	+	-	
3	A.	Do.	1	1	+	+	+	+	+	+	+	-	Staph. epidermidis albus
Test II.													
1	A.	White	1	1	+	-	+	+	+	+	+	-	
2	A.	Do.	1	1	+	+	+	+	+	+	+	-	Staph. epidermidis albus.
3	A.	Do.	1	1	P	+	+	+	+	+	+	-	
4	A.	Orange yellow.	1	1	+	+	-	+	+	+	+	+	

SUMMARY.

Open air.—On three occasions open air was examined for staphylococci characteristic of skin and of scurf. Although a total of 17 different kinds of staphylococci were obtained, not one of them could be identified with Staphylococcus epidermidis albus which is characteristic alike of skin and of scurf.

Air indoors.—On an occasion when the air inside a barber's shop was examined during use, one of the staphylococci obtained

from the air of this shop was identified with Staphylococcus epidermidis albus. On both of two occasions when the air of an operation theatre was examined during use, a staphylococcus identical with Staphylococcus epidermidis albus was obtained therefrom; whereas control tests made on each of these two occasions immediately before the theatre was used, gave uniformly negative result regarding that micro-organism.

CONCLUSION.

These observations tend to show that the staphylococcus test, which, as a result of the preceding investigation of the bacteria of the skin, appeared to be applicable for the purpose of detecting the presence in air of particles shed from the human integument, is as matter of fact successful in achieving that object; in each of three instances when air within doors was examined on occasions when persons were present, particulate matter shed from the skin was contained by that air.

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PART III.

Staphylococci from Disease-processes.

As the preceding enquiry entailed a scrutiny of the characters of a large number of staphylococci, opportunity has also been taken of examining in the same way staphylococci obtained from disease-processes.

It has been known for many years that in a multiplicity of instances abscess, suppuration, and septicaemia are produced by streptococci, by staphylococci, or by both these sorts of micro-organism. It is also now well recognised that in both acute and chronic disease, whether of the medical or of the surgical subdivision, and whether the primary etiological factor in such cases be of "specific" character or not, extra gravity of the illness is in a large proportion of cases brought about by the active intervention of micrococci in the pathological process from the effects of which the patient is suffering. For such conditions there has come into general use an epithet, which, however useful as a general label, is, nevertheless, far too vague an appellation to satisfy requirements indefinitely. The term to which I refer is, of course, "septic."

It was in course of an enquiry into the conditions underlying the genesis of surgical sepsis that Welch was led to make the investigation which resulted in his observing the habitual occurrence on the skin of the staphylococcus which he named Staphylococcus epidermidis albus. Welch, moreover, showed that the micro-organism in question was not an occupant of the surface of the epidermis only, but that it was present in the deeper layers as well. He proved this point in the following way: The surface of the skin having first been thoroughly disinfected in such manner that culture tubes inoculated with scrapings of its surface remained sterile, he proceeded as follows—"A silk thread sterilized by steam and proved by culture methods to be sterile is passed one or more times by means of a sterilized instrument through the skin, is withdrawn, and at once a tube of melted nutrient agar is inoculated with the thread and rolled. This amounts to a ready means of making cultures directly from the deeper layers of the epidermis and the skin, and is a method applicable for many purposes to the bacteriological examination of the skin. By this method the presence of the white staphylococcus, often in pure culture, has been repeatedly demonstrated in parts of the epidermis deeper than were acted upon by any methods of disinfection of the surface of the skin. So far as our observations extend, and already they amount to a large number, this "coccus may be regarded as a nearly, if not quite, constant inhabitant of the epidermis." (American Journal of Medical Sciences, 1891, p. 457.)

This striking observation of Welch's explained, as he pointed out, the reason why "without any flaw in the antiseptic technique of the surgeon" Staphylococcus epidermidis albus was frequently found present in operation wounds. Generally it was observed that the presence of this staphylococcus in such wounds produced no interference with the healing of the wound by primary intention, but sometimes the coccus might cause a little suppuration of a drainage canal, or it might cause a stitch abscess. Sometimes fever without suppuration seemed attributable to the presence of Staphylococcus epidermidis albus. In one case of laparotomy, a peritonitis which clearly started from a part of the peritoneum agglutinated to the inner edge of the wound, was found to have been produced by this staphylococcus of the normal skin.

It has already been mentioned that Welch was unable to absolutely decide whether or not the skin staphylococcus was a separate and distinct micro-organism from Staphylococcus pyogenes albus. The differences which he observed between them were that the skin staphylococcus was less virulent both to men and to animals, and that it clotted milk* and liquefied gelatine rather more slowly than the pus staphylococcus. Other authorities have thrown doubt upon the difference between Staphylococcus pyogenes aureus and Staphylococcus pyogenes albus, and have adduced evidence to show that it is possible to obtain from an undoubtedly pure culture of aureus a strain of a non-pigment-producing staphylococcus, which with the tests at their command could not be differentiated from Staphylococcus pyogenes albus.

It was of considerable interest, therefore, to examine examples of pyogenetic staphylococci by the differential tests employed in the present enquiry and to see if there was ground for believing in the universality of these staphylococci; or whether, as I have already shown to be the case with regard to pathogenic streptococci, the universality theory is unsupported by more intimate knowledge of the nature of these micro-organisms.

Through the kindness of Dr. Andrewes and Dr. Horder I have been able to obtain cultures of staphylococci isolated from various disease processes, and to submit their characters to investigation. The majority of such staphylococci obtained up to the present have proved to be examples of Staphylococcus aureus, which, as is generally agreed, is a far more common cause of suppuration than any of the other staphylococci. The characters of eight staphylococci recovered from disease processes, and as well an example of Staphylococcus pyogenes albus obtained from Kraal of Prague are set out in the following table:—

* The commonest type of Staphylococcus epidermidis albus clots milk very quickly in my experience. As a rule the milk is firmly clotted in three days, and the clotting is accompanied by bleaching and much serum is formed. Liquefaction of gelatine is certainly slower than in the case of Staphylococcus pyogenes aureus, but it may be seen beginning about the third day, and is practically always present by the end of a week.

Characters of Staphylococci from Disease Processes.

No	Source.	Agar.	Broth	Clot in Milk.	Liq. Gel.	N. Red.	Nitrite.	Maltose.	Lactose.	Glycerin.	Mannite.	Guinea Pig.	Mouse.
1	Peritoneal exudation peritonitis, P.M.	White	A.	+	+	+	+	+	+	+	-	Slight swelling, recovery.	Nil.
2	Nasal discharge acute rhinitis. No B. diphtheriæ found.	Do.	A.	+	+	+	+	+	+	+	-	Large swelling, recovery.	Nil.
3	Specimen of staphylococcus pyogenes albus from Kraal. Also recovered from purulent sputum case of empyema	Do.	A.	+	+	-	+	+	+	+	+	Not tested	Died three days after injection with the sputum staphylococcus.
4	Pus empyema	Do.	A.	+	+	-	-	+	+	+	+	Swelling, recovery	Nil.
5	In practically pure culture from a sanguineous nasal discharge. No B. diphtheriæ found.	Creamy yellow	A.	-	-	-	+	+	-	-	+	Swelling, death in 48 hours.	Nil.
6	Peritoneal exudation peritonitis, P.M.	Orange, Staph. Aureus.	A.	-	+	-	+	+	+	+	+	Swelling, death in 48 hours.	Nil.
7	Pus, peritonitis, P.M.	Do.	A.	+	+	-	+	+	+	+	+	Swelling, recovery	Died 10th day.
8	Blood during life. Child with osteomyelitis and pyæmia.	Do.	A.	+	+	+	+	+	+	+	+	Not tested	Not tested.

It will be observed that staphylococci 1 and 2 in the above table, both of the albus class, gave reactions in the differential tests identical with those given by Staphylococcus epidermidis albus, and may therefore be regarded as examples of that micro-organism. Staphylococcus No. 3, however, which, if Kraal's specimen is a correct index, is to be regarded as an example of the true Staphylococcus pyogenes albus, differs from Staphylococcus epidermidis albus in two of the tests, viz., neutral red and mannite. The difference between these two staphylococci with regard to mannite is a particularly important one, because S. epidermidis albus not merely fails to produce acid in this mannite medium, it produces an increase in the alkalinity of it. This strong divergence between the behaviour of two staphylococci in regard to mannite, therefore, is certainly not in favour of the view that they are both examples of the same micro-organism; on the contrary it implies that they are quite distinct.

With regard to pigment-producing staphylococci, it is clear that staphylococcus No. 5, which was amongst other things exceedingly virulent for the guinea-pig, is quite a different micro-organism from the last three staphylococci in the list, viz. Nos. 6, 7 and 8, all of which would readily pass for Staphylococcus pyogenes aureus in ordinary culture-media.

The differences between these three specimens of Staphylococcus aureus occurred in respect of characters to which I am not at present inclined to attach a relatively great differential significance.

It may be added that a tendency shown by Staphylococcus aureus which I have repeatedly observed, is that it acts upon mannite much more rapidly than upon glycerin. By the third day the mannite shows as a rule a strongly acid reaction in the case of this micro-organism, though the reaction of the glycerin may be barely if at all affected in this time. On the other hand most of the other staphylococci which I have found to act upon both these polyatomic alcohols, act more quickly upon the glycerin than upon the mannite.

From the important influence that pathogenic staphylococci exert upon the course and outcome of a large number of diseases, it is highly desirable that, whenever possible, these micro-organisms should be isolated and examined in respect of the characters which have in the present enquiry been found to be of value for the purpose of differentiating them. Such procedure would seem to be a necessary antecedent to the acquirement of more effectual methods of averting the grave consequences that at present too often result from their virulence.

APPENDIX C.

APPENDIX C

Report on Chloroformed Calf Vaccine; by Dr. Green.

REPORT on CHLOROFORMED CALF VACCINE; by Dr. ALAN GREEN.

DURING the year 1904, up to the end of December, preparation of vaccine lymph by means of the chloroform process was continued under my supervision. Such lymph, after passing the usual tests, was issued to public vaccinators in the usual way.

During this period no modification in the method of preparing vaccine in this way has been found necessary; in a few unessential details of manipulation only has change been made. As a whole the chloroforming method described in the Medical Officer's Report, 1903–4, has continued to work very satisfactorily.

Apart from the routine preparation of chloroformed calf vaccine, investigation has been continued in regard to one or two points of interest in connection with this process. These I proceed to deal with.

Glycerine added to or withheld from Calf Vaccine prepared by the Chloroform Process.

Experiments have been made to ascertain whether, in regard of lymph which it is proposed to submit to glycerine as well as to chloroform, it is preferable to add the glycerine to the vaccine pulp *before* or *after* submitting it to the chloroform process; and, if found desirable to defer addition of glycerine to the lymph, to determine the stage of the chloroform process at which the glycerine should be added to lymph which has been freed from extraneous micro-organisms.

For these experiments pulp collected from a given calf was divided into five equal portions, the several portions being dealt with as follows:—

FIRST PORTION.—This was admixed with twice its own weight of sterile distilled water, after which it was chloroformed for four hours in the manner described in the Medical Officer's Report, 1903-4. The entrance and exit of the emulsion tube were then clamped to prevent the escape of any chloroform, and the emulsion was maintained in this condition for *twenty hours*. At the end of this time this emulsion was subdivided into three equal parts, (*a*), (*b*), and (*c*).

From the *first part* (*a*), the chloroform was at once removed. Undiluted glycerine was then added to it in the proportion of two

parts by weight of pure glycerine to the original weight of pulp. The emulsion, as thus constituted, was kept until it was required for the inoculation of calves.

From the *second part* (*b*) the chloroform was partly removed at the end of 24 hours from the beginning of the chloroforming, leaving only sufficient chloroform present to prevent the increase of any small number of extraneous micro-organisms which might possibly have survived in the bulk of the emulsion. The vaccine was kept thus until just before use for inoculating calves, when the remainder of the chloroform present was removed, and pure glycerine, in the proportion of two parts by weight to the original weight of pulp, was added.

From the *third part* (*c*) the chloroform was partly removed as in the case of (*b*), and the emulsion was kept in this condition until used, without addition of glycerine, for the inoculation of calves.

SECOND PORTION.—This was admixed with twice its own weight of sterile distilled water, and was chloroformed for four hours. The entrance and exit of the emulsion tube were then clamped to prevent the escape of the contained chloroform, and the emulsion was kept under these conditions for *one week*. At the end of this time the emulsion was subdivided into three parts (*d*), (*e*), and (*f*).

From the *first* of these parts (*d*), the contained chloroform was at once removed, and undiluted glycerine was added in proportion of two parts by weight to the original weight of pulp. The emulsion, as thus constituted, was kept until required for the inoculation of calves.

From the *second* of these subdivided parts (*e*) the chloroform was partly removed at the end of 24 hours in the same manner as from (*b*) and (*c*), and the emulsion was then kept until just before use for inoculation, when the remainder of the chloroform was removed and undiluted glycerine was added to the emulsion in the proportion of two parts by weight of glycerine to the original weight of pulp.

From the *third* part (*f*) the chloroform was partly removed in the same manner as before, and the emulsion was kept until used, without addition of glycerine, for inoculation.

THIRD PORTION.—This was admixed with twice its own weight of sterile distilled water, and the resulting emulsion was chloroformed for four hours, when the entrance and exit of the emulsion tube were clamped, and the emulsion then stored for *six months*. At the expiration of this period the emulsion was subdivided into two parts, (*g*) and (*h*), the contained chloroform not being driven off.

To the *first* part, (*g*), undiluted glycerine was added in the proportion of two parts by weight to the original weight of pulp. The resulting emulsion was then used for inoculation.

The *second* part, (*h*), was used for inoculation without any alteration in its condition being made.

FOURTH PORTION.—The pulp was admixed with four times its own weight of 50 per cent. solution of glycerine and distilled water, and the resulting emulsion was subjected to the chloroform process for four hours. At the end of this time the emulsion was subdivided into three parts, (*i*), (*j*), (*k*).

From the *first* part, (*i*), the chloroform was at once removed.

From the *second* part, (*j*), the chloroform was not removed until the expiration of the eighth day after its subjection to chloroform.

From the *third* part, (*k*), the chloroform was not removed at all, the emulsion, with glycerine and chloroform both present in it, being used for inoculation.

FIFTH PORTION.—The pulp was admixed with four times its own weight of 50 per cent. solution of glycerine and distilled water. This portion was not subdivided, *and was not associated with chloroform in any way*; it was used as a glycerinated control to PORTIONS 1, 2, 3, and 4, and their subdivided parts.

The foregoing portions of vaccine emulsion were stored at room temperature.

In the case of the chloroformed emulsions and their subdivided parts, the bactericidal action of the chloroform process on the extraneous micro-organisms was tested, so as to make certain that these micro-organisms had been in each case eliminated. As such large numbers of vaccines have now been treated by this process, it is unnecessary to give the details of the elimination of these micro-organisms at length in the present instance. Some details of this elimination are given in Table I.; but here it will suffice to say that elimination of non-sporebearing extraneous micro-organisms per platinum loopful of emulsion was practically complete in every case after subjection to the chloroform process for four hours.

With reference to the influence of various combinations of chloroform in solution in water, and glycerine in solution in water, on the potency of the active principle of vaccinia :—

As will be seen from Table I., the influence on the activity of the lymph of the chloroform and glycerine in solution in water, both separately and in combination, may be broadly outlined under two heads: The one where marked deterioration or loss of potency of specific activity was manifested; the other where no such deterioration was apparent. This distinction is more especially evident in the case of the six months old emulsions. There are also some isolated instances of deterioration, or of doubtful deterioration, of potency to be seen here and there; but their occurrence is not sufficiently constant to allow, in the present limited series of experiments, any deduction to be drawn as to the reason in their cases for deterioration.

APPENDIX C.

Report on Chloroformed Calf Vaccine; by Dr. Green.

	ENT No. 4.			EXPERIMENT No. 5.				
	s of ms.	Potency.		No. of Colonies of extraneous Micro-organisms.			Potency.	
	At end of 3 months.	At end of 3 months.	At end of 6 months.	At mixture.	At end of 4 hours.	At end of 3 months.	At end of 3 months.	At end of 6 months.
	0	+	?		0	0	+	+
	0	+	?		0	0	+	+
No. with then st								
	0	+	+		0	0	+	+
	0	+	+		0	0	+	+
	0	+	+		0	0	+	+
No. with then st								
	0	+	?	11,000	2	0	+	+
	0	—	?		0	0	—	+
No. 3 with c subdiv	0	—	-		0	0	—	+(?)
	0	+	+		0	0	+	+
No. added chloro	0	?	?		0	0	+	+
	0	?	-		0	0	+	-
No. 5 P	0	+	?		—	3	+	+

APPEN

Report
Chlorof
Calf Va
by Dr. (

But from certain well marked instances of loss of potency on the one hand, and certain instances of definitely retained potency on the other, it seems justifiable to conclude that *the combined influence* of chloroform and glycerine in solution in water was prejudicial to the active principle of the vaccine. Also, it is to be inferred that the action of chloroform dissolved in water, and that of glycerine dissolved in water, was harmless; at any rate, this appeared to be the case when these two substances were used separately, and when the action of one followed on that of the other.

Experiment having thus far been made, and the fact having been ascertained that injury to the specific virus might occur from glycerine and chloroform in simultaneous combination, the precaution was subsequently taken in preparing vaccines by the chloroform process to avoid the simultaneous action on vaccine of chloroform and glycerine in solution in water. Any association of the vaccine emulsion with glycerine was deferred until such time as the work of the chloroform in removing the extraneous non-sporebearing bacteria had been fully performed, and until the chloroform had been completely removed from the vaccine. The procedure detailed in my paper which appeared in the Medical Officer's Report, 1903–4, was, in fact, adopted.*

The Elimination of Extraneous Micro-organisms from Vaccine by the Chloroform Process.

Attempts have been made to ascertain whether spores commencing to germinate into bacillary forms can be eliminated from vaccine emulsion without causing injury to the active principle of the lymph.

It is well known that germicidal agents which are of sufficient strength to kill spores in such phase are fatal, usually in a brief time, to the specific action of vaccine.

It seemed possible, however, by using the chloroform process intermittently on a vaccine emulsion containing extraneous micro-organisms in the form of spores, and by attempting to make those spores germinate to the bacillary form in the intervals of applying chloroform, that the vaccine might be freed from such extraneous micro-organisms. This method would, in fact, be parallel to the "discontinuous" method of sterilisation by heat.

Such intermittent chloroforming has—with many variations—been attempted as follows:—

Vaccine pulp was mixed with twice its own weight of distilled water. To this emulsion a small measured quantity of broth emulsion of some spore-bearing micro-organism was added, the micro-organism being in a sporing stage.

---

* The foregoing experiments were begun in 1903, though only recently completed.

This mixture of emulsions was chloroformed in the usual way for from two to six hours at 20° C. At the end of this time the chloroform was removed from the mixed emulsion, which was then placed at a temperature varying between 25° C. and 37° C., in order that the spores, having the assistance of a nutrient medium, might develop to the bacillary form.

After an interval to allow of such development, the emulsion was again subjected to the action of chloroform. This alternate chloroforming and incubating were continued in some cases as many as six times.

Bacteriological cultures and microscopical examinations were made of the emulsions before and after each application of chloroform and each incubation.

So far, complete elimination of spores has not been attained, though their numbers have very markedly reduced, by the process in question. And this reduction in number of spores has been compatible with the retention by the vaccine of a considerable degree of potency when intermittent incubations have been conducted at a temperature not higher than 30° C., though control portions of the vaccine, kept for the same length of time as the experimental portions, but at 10° C., usually showed higher potency.

The tests for potency were made on calves, and only such vaccines as had been admixed with non-pathogenic spores were so tested.

It seems improbable that complete elimination of spores is possible by the foregoing method. The germination of spores to bacilli would seem to take place after the application of chloroform. But during the action of the chloroform process some of these newly-born bacilli are apparently capable of developing spores, and thus this form of micro-organism is again present in the emulsion, though, as a rule, in lessened numbers.

This question of the elimination of spores from vaccine is however, of purely scientific interest, and has no bearing on the capabilities of the chloroform process from a vaccine preparation point of view. For it is safe to assert that, were spores of a pathogenic micro-organism found in a batch of lymph, the lymph would be forthwith destroyed, irrespective of any possibility of the removal of the micro-organisms from the vaccine.

The Issue and Use of Chloroformed Calf Vaccine.

During 1904, up to the end of December, vaccine has been prepared by the chloroform process, and has been issued to public vaccinators after it has passed the usual tests,

Table 2 shows details of the results of the use of

TABLE 2,

...e use of 56 chloroformed vaccines.

	...or—	Percentage success.	
	...ber of Cases.	Case.	Insertion.
...cinations	48,909	98·1	92·7
...e-vaccinations	7,478	97·8	94 0
Total...	56,387	98·1	92·9

The Use of Chloroformed Calf Vaccine in Hot Climates.

Indication as to the utility of the chloroform process in the preparation of vaccine in a hot climate has been furnished by Dr. V. de la Guardia, in a paper which he has published.* This paper contains the results that Dr. V. de la Guardia obtained by the use of chloroformed vaccine in Cuba, results which were very successful.

Dr. V. de la Guardia very kindly sent me some capillary tubes of vaccine derived from vesicles which had been "collected" from the calf on October 10th, 1904. The vaccine was chloroformed by Dr. V. de la Guardia, and the tubes reached me early in December, 1904.

I inoculated the contents of these tubes on a calf a week after receiving them, and, contrary to expectation, obtained, as a result in every instance, well developed vesicles of normal appearance and good quality 120 hours later.

* Rapida Purificacion de la Vacuna Anti-Variolosa, por el Dr. V. de la Guardia, Director del Centro de Vacuna, Habana. Veido en la Academia de Medicina el 10 de Marzo de 1905.

TRANSMISSION OF PLAGUE IN THE RAT.

PLATE I.

FIG. 1.

Reproduced from a section through the affected Peyer's patch of the ileum of a rat dead of plague after feeding; seen under a low magnifying power.

At 1. Piece of "food" (crowded with B. pestis) wedged in and fastened at the pit of the mucous membrane corresponding to the internal portion of the Peyer's gland.

At 2. A swollen and partially necrotic lymph follicle.

At 3. Lymph spaces surrounding a large blood vessel filled with continuous masses of B. pestis.

At 4. Lymph vessels filled with B. pestis between the layers of the outer muscular coat.

At 5. Necrotic mucous membrane filled with extravasated blood and masses of B. pestis.

[Magnifying power, 25.]

FIG. 2.

Large blood vessel of the submucosa (3 of Fig. 1) containing numerous B. pestis amongst the blood corpuscles, surrounded by lymph space filled with B. pestis.

[Magnifying power, 300.]

PLATE I.

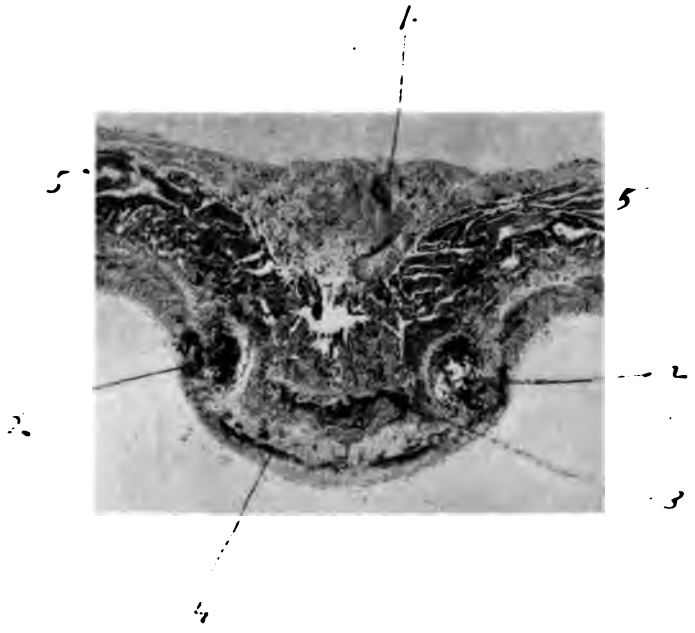


FIG. 1.

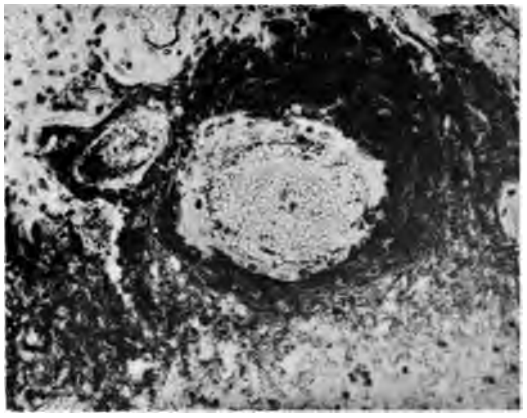


FIG. 2.

PLATE II.

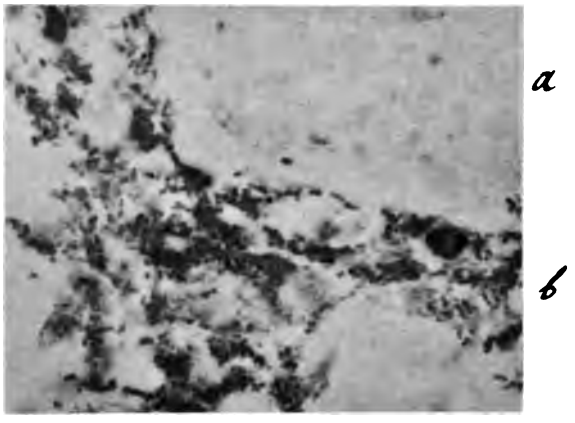


FIG. 3.

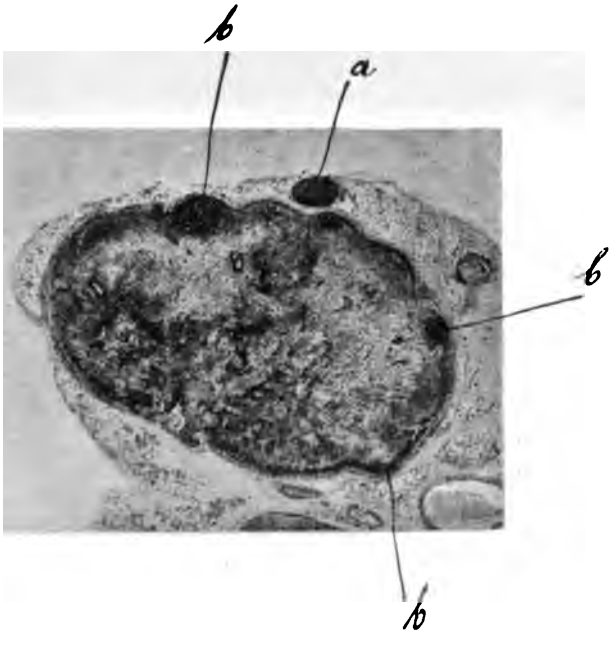


FIG. 4.

TRANSMISSION OF PLAGUE IN THE RAT.

PLATE II.

FIG. 3.

Part of Fig. 2, more highly magnified.

a. Blood corpuscles within the blood vessel.

b. B. pestis in surrounding lymph spaces.

[Magnifying power, 1,000.]

FIG. 4.

Transverse section through mesenteric gland of a rat dead of acute plague after feeding.

a. An afferent lymph vessel filled with B. pestis.

b. Cortical lymph sinuses filled with B. pestis.

All the light areas of the figure are the parts containing extravasated blood, the black parts are masses of B. pestis. In the actual preparation, which was stained with methyleneblue and eosin, the contrast between the masses of B. pestis (blue) and the extravasated blood (pink) was particularly striking.

[Magnifying power, 20.]

TRANSMISSION OF PLAGUE IN THE RAT.

PLATE III.

FIG. 5.

From a section through the testis of rat 1 (Figs. 1, 2).

1. A small arteriole showing a rupture (at its upper end). The tissue around it and the lymph spaces between the seminal tubules, seen here in cross section, are filled with the extravasated blood.

2. Masses of B. pestis in this extravasated blood.

[Magnifying power, 120.]

FIG. 6.

Reproduced from a section through the ileum, at the site of hæmorrhage, of a mouse dead of acute plague after feeding.

1. A villus containing a large amount of extravasated blood; its central lymph vessel, 3, seen in section, is filled with B. pestis; the same appears at *3a* and *3b*.

2. A villus denuded of its epithelium and permeated in reticular form by masses of B. pestis; the same as during absorption with chyle.

[Magnifying power, 165.]

PLATE III.

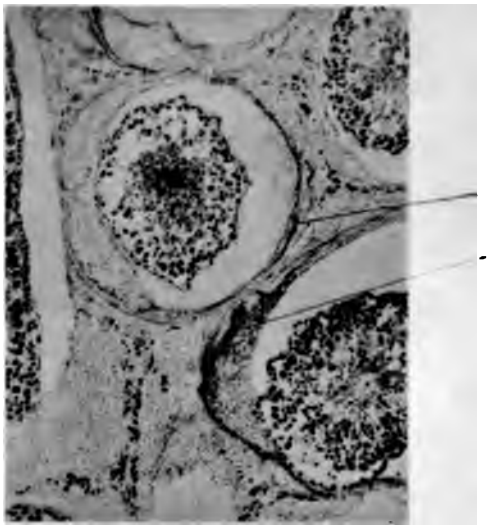


FIG. 5.

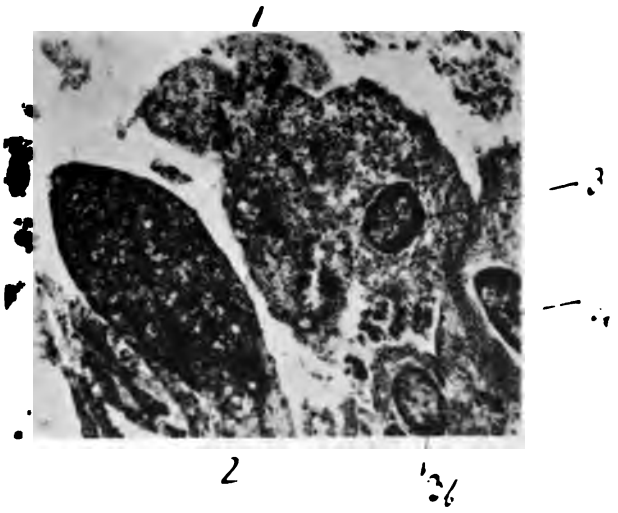


FIG. 6.

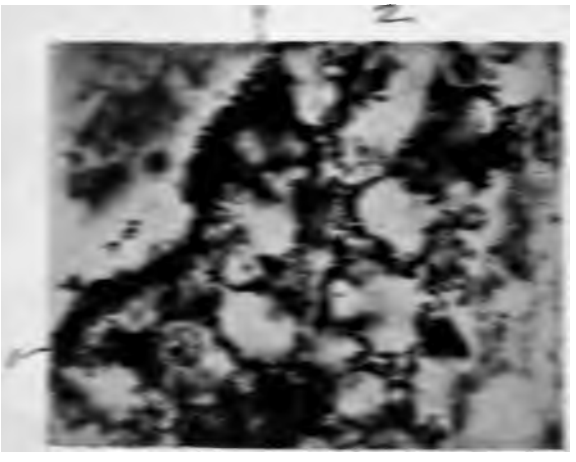


Fig. 2.

Fig. 3.

TRANSMISSION OF PLAGUE IN THE RAT.

PLATE IV.

FIG. 7.

Part of a similar villus to that in Fig. 6, more highly magnified.

At 1. Surface of villus covered with continuous masses of B. pestis, which extend (2) in reticular formation between the tissue elements of the villus; exactly the same appearances as are shown by a villus in an active state of ordinary absorption with chyle, with the difference that in the particular case the chyle globules are replaced by B. pestis.

[Magnifying power, 1,000.]

FIG. 8.

Transverse section through the affected part of the ileum of a rat dead after feeding with plague material, *i.e.*, plague spleen dried in wheat.

In the interior of the gut is a particle of material fixed a little above the section to the inflamed and necrotic Peyer's gland. This particle consists of a central mass, of spleen tissue full of B. pestis, surrounded by semi-digested wheat.

The villi contain abundance of B. pestis similar to what was shown in Figs. 6 and 7.

[Magnifying power, 25.]

TRANSMISSION OF PLAGUE IN THE RAT.

PLATE V.

FIG. 9.

A portion of the above food particle (Fig. 8) more highly magnified.

a. Gluten bodies and separating membranes.

b. The same, but permeated by masses of B. pestis.

c—*c*. Bit of plague spleen with numerous B. pestis.

[Magnifying power, 300.]

FIG. 10.

Part of previous figure more highly magnified.

a—*a*. Semi-digested wheat permeated by masses of B. pestis.

b. Piece of plague spleen (blood corpuscles are well shown) with numerous B. pestis forming aggregations at the margin of spleen and wheat. This tends to indicate that the wheat does not offer any antagonism or inhibition to the multiplication of B. pestis brought in contact with it.

[Magnifying power, 700].

PLATE V.

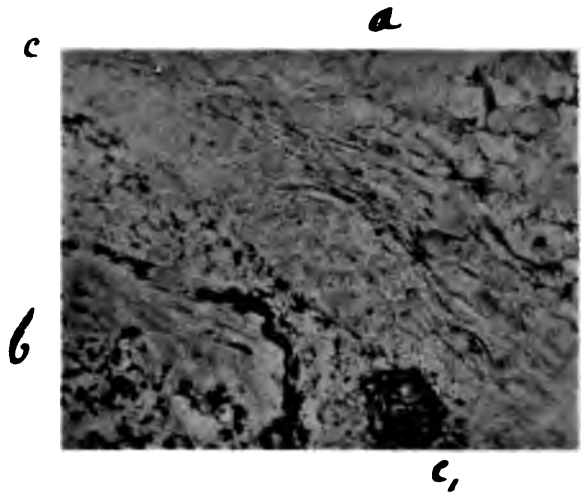


FIG. 9.

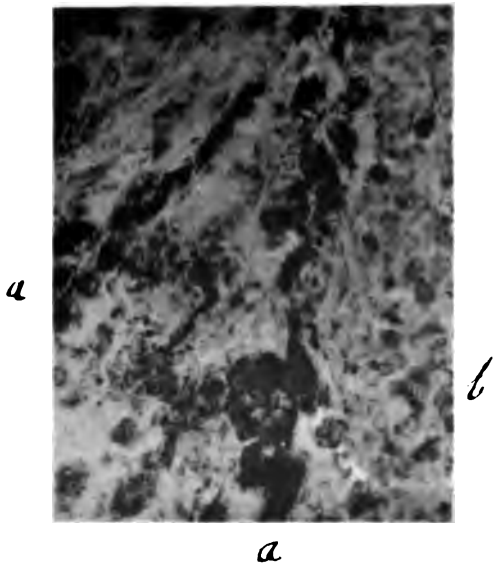


FIG. 10.

PLATE VI.

FIG. 11.

FIG. 12.

TRANSMISSION OF PLAGUE IN THE RAT.

PLATE VI.

FIG. 11.

Section through mesenteric gland of a sewer rat dead after feeding with semi-dried plague organs.

The light parts are filled with extravasated blood, the dark parts contain masses of B. pestis filling the cortical and medullary sinuses.

1. Two efferent lymph vessels in section filled with B. pestis; there is seen at the hilum (2) an efferent lymph vessel filled with B. pestis, just emerging from the gland.

1*a*. An afferent lymph vessel filled with B. pestis.

[Magnifying power, 45.]

FIG. 12.

Section through a necrotic patch of the spleen of a guinea pig dead with subacute plague after inoculation with "plague earth."

The dark masses are aggregations of B. pestis; on inspection with a glass it is recognised that these masses are in networks of blood spaces.

[Magnifying power, 100.]

TRANSMISSION OF PLAGUE IN THE RAT.

PLATE VII.

FIG. 13.

Section through a necrotic nodule of the lung of the guinea pig referred to in Fig. 12.

The ramifications of the alveolar duct, with its alveoli filled with B. pestis, are recognised as forming the main part of the nodule; the dark masses in the alveolar duct and alveoli are conglomerations of B. pestis.

[Magnifying power, 100.]

PLATE VII.

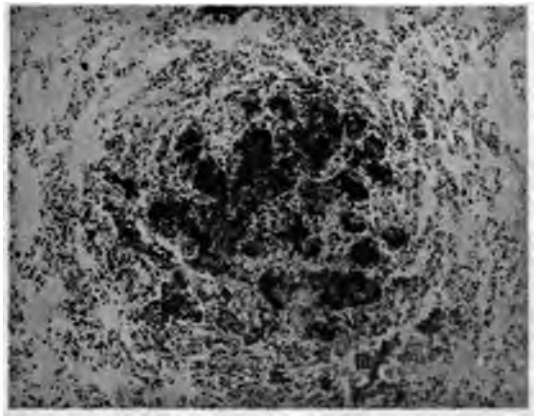
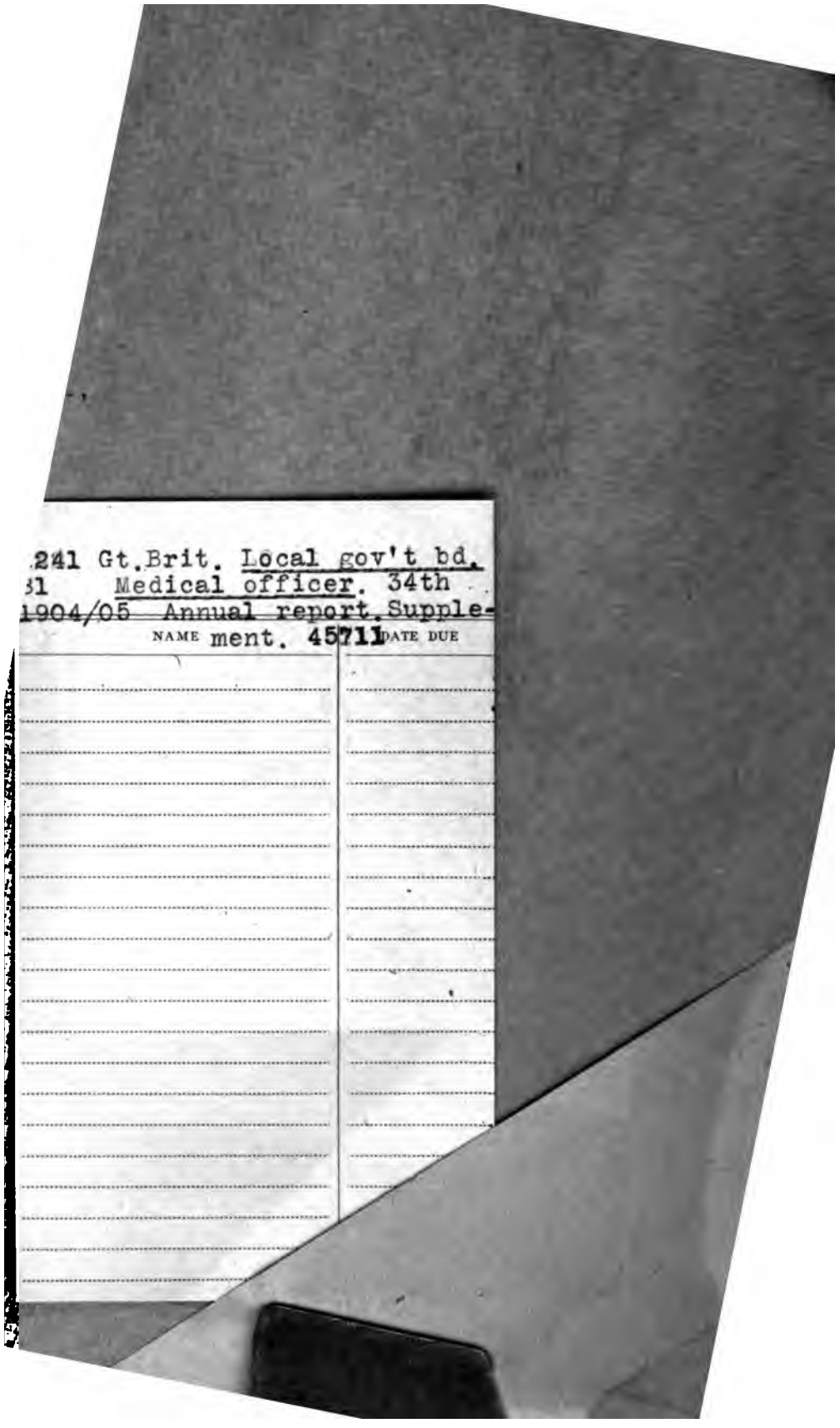


FIG. 13.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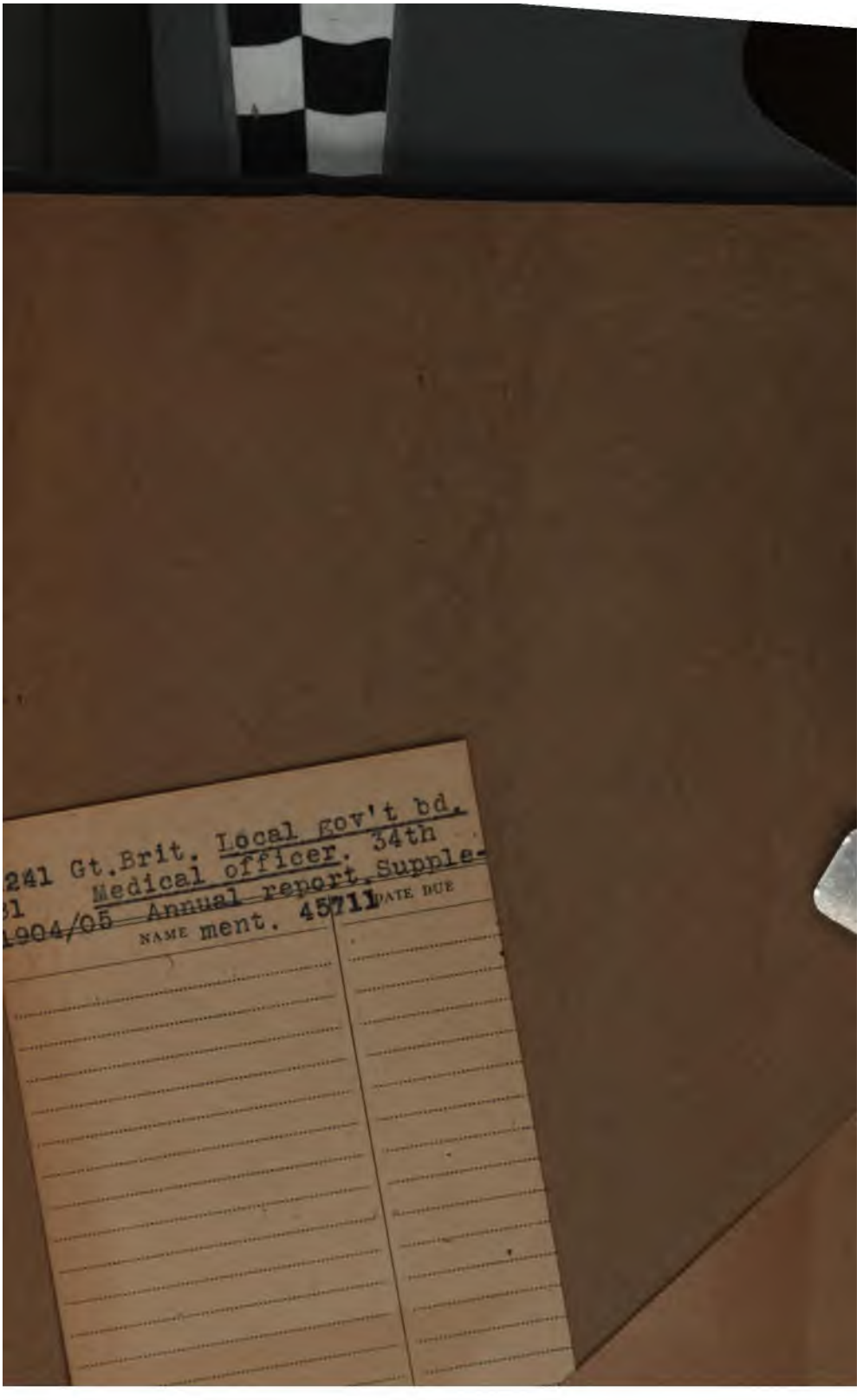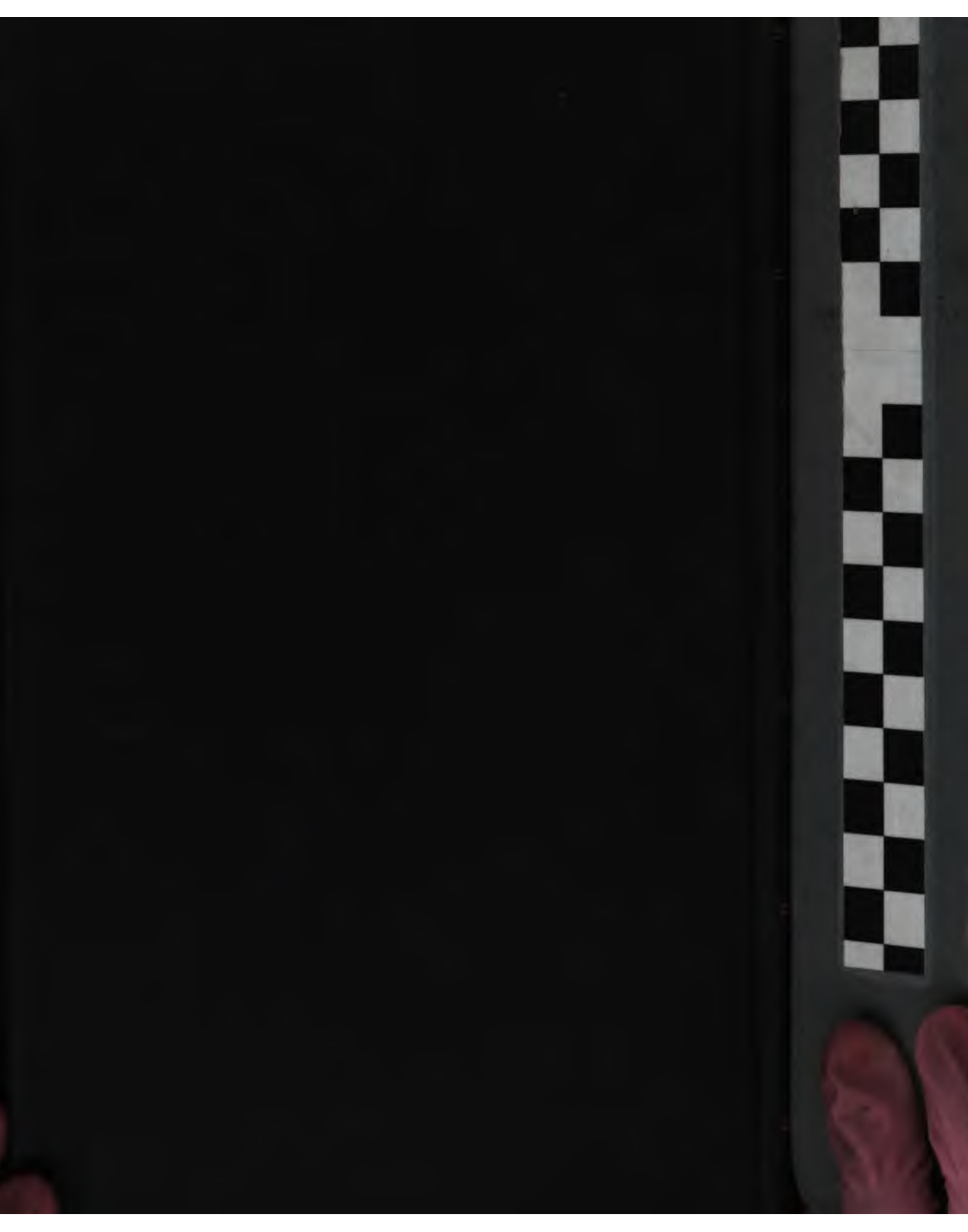
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